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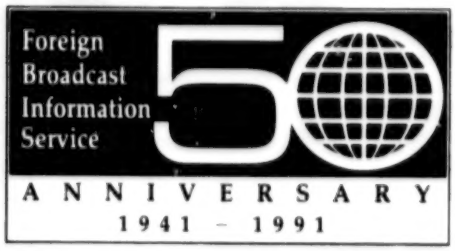

JPRS Report

Science & Technology

Europe

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Germany: Heraeus Develops Furnace For Superalloys

91MI0072 Duesseldorf HANDELSBLATT in German 15 Nov 90 p B8

[Article by Dr. Alok Choudhury of Leybold AG, Hanau: "Basis for Production of High-Purity Superalloys"]

[Excerpt] [Passage Omitted] The following advantages are among those determining the increasing proportion of output from vacuum induction smelting plants:

- Flexibility resulting from small batch sizes;
- Rapid changeover in production between different types of steel and alloy;
- Low losses of the expensive alloying elements on ignition;
- Adherence to the strictest analysis tolerances;
- Low hydrogen and nitrogen content;
- Precise temperature control;
- Removal of undesirable trace elements with high steam pressures;
- Low nonmetallic inclusions of content;
- Low levels of environmental pollution from dust exhaust.

Constantly Increasing Material Purity Requirements

The vacuum induction smelting process is indispensable for the production of Ni- and CO-based superalloys and for high-alloy steels, which must be smelted in an inert-gas atmosphere or under vacuum because of their reactivity with oxygen. This avoids oxidation reactions with the atmospheric oxygen and the associated formation of oxidic inclusions.

The vacuum induction melter is extremely versatile. The casting weights range from a few kilograms to 15 metric tons depending on whether a precision casting or bloom furnace or refining electrodes are used.

Despite the outstanding advantages of vacuum induction smelting, the specific processing technique means that it is not sufficient to separate the endogenously formed oxides out from the molten mass to meet the present high material purity requirements set for various applications. For example, in the case of superalloys for aircraft engine construction, the material produced in the vacuum induction furnace is remelted again in a vacuum arc furnace, which gives both controlled solidification and a higher degree of purity.

It has been shown that the degree of purity of the remelted ingot depends on the degree of purity of the electrode used. However, additional refining would not be cost-effective for several alloys and steels. Moreover, the investment costs for a conventional vacuum induction melter are very high. For these reasons—high investment input without optimum melt purification—a new furnace, known as the VIDP [expansion not given] furnace, has been developed.

The VIDP furnace is a further development of the conventional vacuum induction melter (VIM). It has an independent smelting and processing unit, to which various casting systems can be linked according to the modular principle.

Unlike the conventional vacuum induction melter, the VIDP furnace does not have a separate vacuum chamber, but is vacuum-tight itself. Accordingly, a much smaller portion of the furnace has to be evacuated. Whereas the chamber of a 6-metric ton VIM has a volume of approximately 80 m^3, a furnace volume of 8 m^3 is sufficient for a 6-metric ton VIDP. The advantages in terms of investment input are thus obvious.

A vacuum-tight lid is secured via a fast-action bayonet fitting to the furnace body containing the induction coil and the crucible. The furnace body can be extracted for relining or replacement with another, ready-lined, furnace body. This substantially shortens set-up times. All the hydraulic crucible tilting devices and the flexible, water-cooled power cables are outside the furnace cavity.

Metallurgical Work in the Long Trough

The melt can be cast under vacuum or under protective furnace gas. A trough is used to convey the molten mass to the actual casting chamber. Just prior to casting, a vacuum valve positions the preheated ceramic trough. An additional electric heating system offsets the temperature losses from the trough during casting. The actual casting is done in a separate casting chamber, which may be designed for ingot or continuous casting or for powder atomization and connected to the furnace.

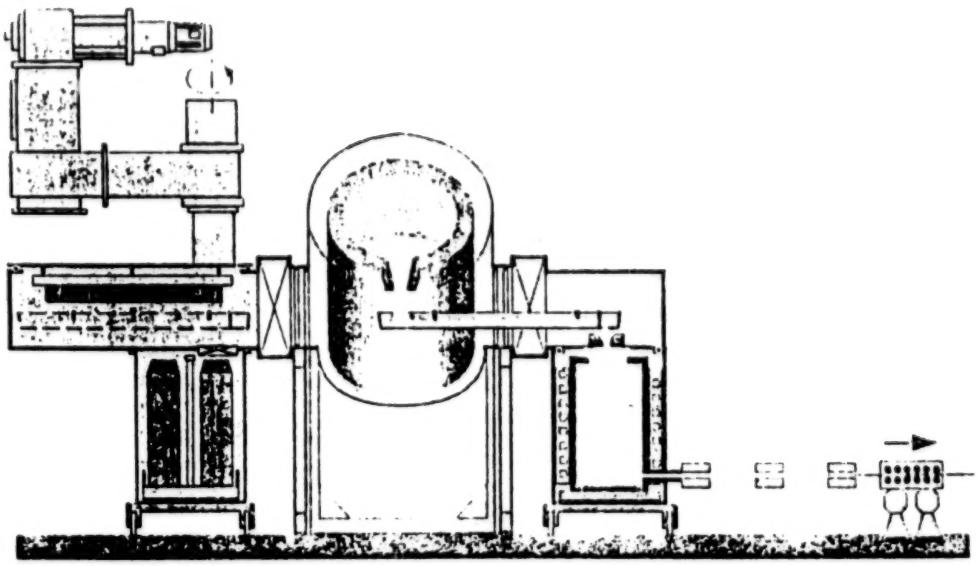
While the VIDP furnace is comparable with the conventional VIM as far as metal processing under vacuum is concerned, the relatively long trough for conveying the melt is a distinctive feature. The trough not only conveys the melt to the casting chamber but also performs the metallurgical task of separating out the oxides.

The trough is fitted with two slag barriers spaced, in the light of the desired casting speed, to curb the turbulent flow of the melt between them as much as possible and create an almost laminar flow. As a result, the oxide inclusions separate out from the melt in accordance with Stokes' law and fail to reach the mold.

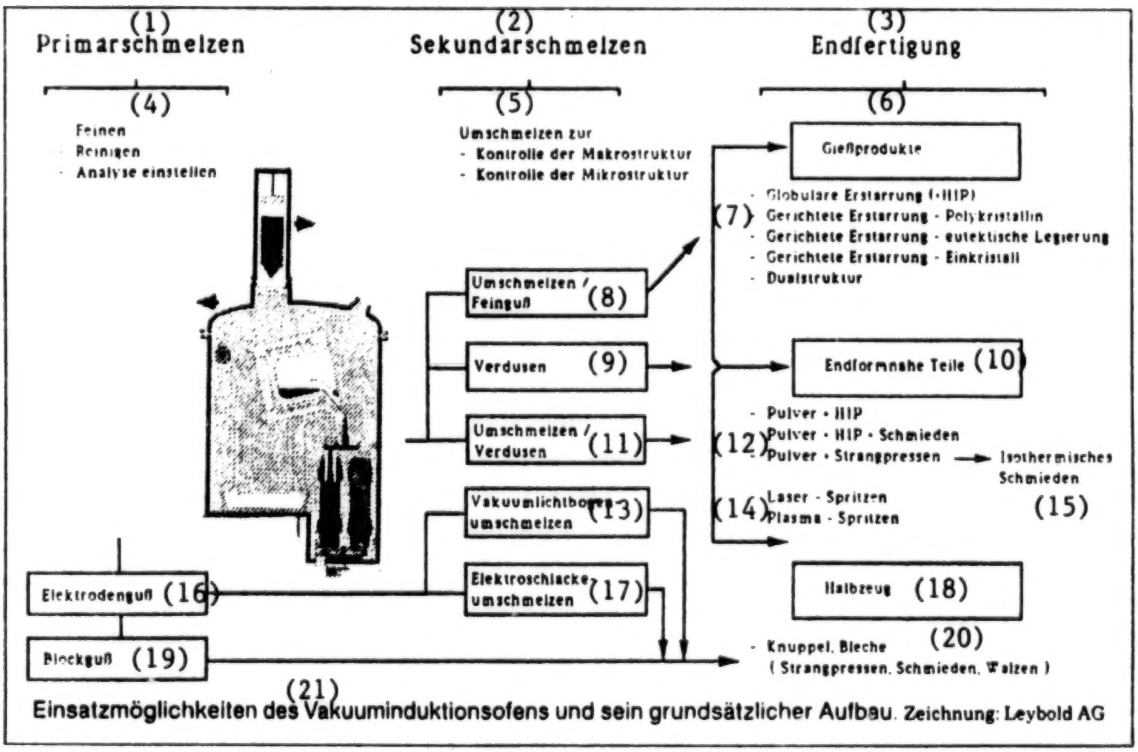
A ceramic foam filter can also be mounted in front of the outlet to prevent even the finest oxides from flowing into the mold with the melt.

The operating results obtained with the 6-metric ton VIDP furnace confirms that all oxide inclusions with a diameter or length of > 20 micrometers separate out in the trough, even without a ceramic filter. The degrees of purity achieved with Ni-based alloys are comparable with those of the refined material.

Several VIDP furnaces for melt weights between 500 and 8,000 kg are already in operation in various parts of the world. The VIDP furnace is also being used for nonferrous metals such as Al, Cu, and their alloys, not only for high-purity superalloys and steels.



VIDP concept with combined ingot and continuous casting. (Drawing: Leybold Corporation)



Key: 1. Primary smelting 2. Secondary smelting 3. Finishing 4a. Refining 4b. Purification 4c. Analysis 5a. Remelting for 5b. macrostructure control 5c. microstructure control 6. Castings 7a. Globular solidification (+ HIP [hot isostatic pressing] 7b. Directional solidification - polycrystalline 7c. Directional solidification - eutectic alloy 7d. Directional solidification - crystal 7e. Dual structure 8. Remelting/fine casting 9. Atomization 10. Partially finished parts 11. Remelting/atomization 12a. Powder + HIP 12b. Powder + HIP + forging 12c. Powder + extrusion 12d. Laser-spraying 12e. Plasma-spraying 13. Vacuum arc remelting 14. Isothermal hot-die forging 15. Electrode casting 16. Electroslag remelting 17. Semifinished product 18. Ingot casting 19. Billets, sheetmetal (extrusion, forging, rolling) 20. Billlets (extrusion/forging rolling) 21. Ways of using vacuum inductionm furnace and its basic structure. (Drawing: Leybold Corporation)

Germany: GigaRam To Be Used for Soundproofing, Noise Abatement

91P60081P Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 24 Dec 90 p 10

[Excerpt] Capping years of R&D time, Messerschmitt-Boelkow-Blohm's (MBB) Ottobrunn facility has begun using GigaRam for soundproof barriers at airports in Bremen and Munich. GigaRam is a radar-absorbent material (RAM) initially conceived as a "camouflage cover" for aircraft and was further developed for use in housing facades, walls, roofs, on towers, bridge structures and complete airport terminals. The RAM can be adapted for use with a variety of other materials including ceramic, glass, plastic, and reinforced concrete and can even be woven into a wire mesh through which vegetation can grow. Initial testing involving a building constructed using GigaRam showed that the structure reflected virtually no [sonic] signal, thus causing the Federal Institute for Air Safety to designate the RAM as the safest noise absorption approach to date, according to MBB. The RAM is slated for use in the future construction of a soundproof facility for testing operational powerplants in airworthy aircraft at the new Munich-Erding airport.

Belgium: Advanced Ceramics Projects Reviewed

91AN0059 Brussels INDUSTRIE in Dutch Sep 90 pp 74-77

[Article by Robert Declerck: "SCK-Mol and Technical Ceramics: Realism After Euphoria"]

[Excerpt] [passage omitted]

Projects on a European Scale

One of the projects currently being worked on at the Ceramics Workshop of the Nuclear Research Center (SCK) in the Belgian town of Mol involves the development of an autorecuperative burner with a double-finned ceramic heat exchanger. This concept is being developed with EC support by a Belgo-French group including the SCK, the Faculte Polytechnique Mons [university], Hepworth Refractories (Belgium), and Ceramiques et Composites (France). The use of this type of ceramic heat exchanger considerably improves the efficiency and the compactness of the autorecuperative burner. The project has resulted in a considerable increase in operating efficiency, which far exceeds initial expectations. There are still some production-related problems, but the partners are so pleased with the initial results that they are seeking financing to continue the project.

One of the techniques used in technical ceramics production is that of hot isostatic pressing (HIP). At the moment, a critical evaluation of this technique is being carried out in cooperation with AEA Technology Harwell (UK) and National Forge Europe/IMT of St-Niklaas (Belgium). This multicustomer study is cofinanced by the EC Commission, along with such large companies as BP and Rolls-Royce.

A microwave-based technology for nondestructive testing of advanced ceramics is being developed by SCK in cooperation with the Societe Francaise de Ceramique, Ceramiques Techniques Desmarquest, the French National Office for Aerospace Studies and Research (ONERA), and British Ceramic Research. The project is still in the start-up phase. The interaction of microwaves with several types of ceramics has already been tested. It is now up to ONERA to build a prototype machine that can trace ceramic defects.

The SCK is also involved in two international projects dealing with the development of specific ceramic compounds with high-temperature superconducting properties. One of the projects involves plasma-spraying of superconducting ceramics for magnetic shielding, applicable, for instance, in measuring instruments for space projects. The other project, in cooperation with the Dutch Energy Research Center (ECN), is looking into the production of superconducting wires and tapes in strong magnetic fields.

Another area of research is that of reaction sintering, with the emphasis on the production of silicon nitride. The conventional production technique uses a silicon-nitride powder that is molded and subsequently baked. In reaction sintering, a silicon metal is used for molding; the actual reaction then takes place at a high temperature in a nitrogen atmosphere. The nitrogen binds with the silicon to make silicon nitride. There are arguments for and against both procedures. The silicon-powder-based process leads to considerable shrinkage, whereas with reaction sintering there is virtually none. The disadvantage of reaction sintering is that it cannot reach the full density, but only 85 percent. This has a negative impact on the ceramic's mechanical properties, because many fractures originate in the material itself. Meanwhile, an interesting application was developed using this technique: an accurately mountable rotating component.

A study concerning the production of ceramics using a sol-gel process has already been concluded. The SCK is looking for potential users. The SCK's Ceramics Workshop is involved in other projects to keep up to date with new developments. One of them is a laser-assisted chemical vapor deposition (CVD) project.

AEROSPACE, CIVIL AVIATION

ESA, Aerospatiale To Develop Infrared Space Observatory Satellite

91WS0063A Paris ELECTRONIQUE ACTUALITES in French 12 Oct 90 p 9

[Text] The European Space Agency (ESA) and Aerospatiale Company have wrapped up the final agreement to

develop the ISO (Infrared Space Observatory) astronomical laboratory slated to be launched in 1993 by an Ariane rocket.

The agreement covers development and manufacture of the satellite, which will cost approximately 1.5 billion French francs. ISO will be built in Cannes by a European consortium run by Aerospatiale and made up of thirty European manufacturers, including MBB-Erno (FRG), Selenia (Italy), Fokker (Netherlands), ETCA (Belgium), and Casa (Spain).

The satellite will travel a very elliptical, almost equatorial orbit, 1,000 km at perigee and 70,500 km at apogee, in 24 hours. From that vantage point, the ISO should allow astronomers to considerably expand their knowledge of the Universe by picking up infrared radiation sources 1,000 times weaker than those scientists have been able to study till now.

The satellite's telescope is 60 cm in diameter with a focal distance of 9 meters; it is designed to make infrared measurements of wavelengths ranging from 3 to 200 micrometers (mu-meter). The sky pictures from the ISO will be analyzed by teams of astronomers in France, Great Britain, Germany, and the Netherlands.

European Space Research Institute Programs Outlined

91MI0030 Rome SPAZIO INFORMAZIONI in Italian 1-3 Oct 90 pp 2-2

[Interview with Engineer Francis Roscian, director of ESRIN, in Frascati, Rome]

[Text] Major space missions are best represented by their respective "space segments" (be they satellites, orbiting stations, or interplanetary probes). However, a fact that is often underestimated by many is that nothing in outer space can carry out its mission satisfactorily unless supported by a network of earth stations and monitoring centers which are also responsible for processing and distributing the data collected. It is precisely this important part of the so-called "earth segment" that characterizes ESRIN's [European Space Research Institute] activities in Frascati (Rome). ESRIN is an ESA (European Space Agency) center that provides information management services to a large number of users. In particular it is currently involved in programs such as IRS (Information Retrieval Service), EPO (Earthnet Programme Office), and IDS (Information System Division), and will become an indispensible element in many of the ESA's future projects: the ERS-1 and ERS-2 [Earth Remote Sensing] satellites and the network of orbiting platforms planned for the Freedom international space station. In the following interview, Francis Roscian, ESRIN's director since 1984, confirms that this Italian-based European establishment is about to undergo a period of expansion both in terms of personnel as well as funds for the construction of new infrastructures.

SPAZIO INFORMAZIONI: What will ESRIN's new activities be in the coming years?

Roscian: First, this center already has a specific and well-defined role in the general program and this is to manage the data received from the ESA's satellites. To be more precise, considerable developments are projected in the field of remote sensing satellites. In fact, we have already prepared a very important data center for the ERS-1 since it will be required manage all the information received from the satellite. The center will work with various receiving stations on earth including one of the major stations, the one located in Fucino. This is generating a good deal of work already.

SPAZIO INFORMAZIONI: Will you therefore require more staff and infrastructures in the near future?

Roscian: Precisely, we are working with these very prospects in mind. Over the past five years, our staff has increased from 60 to 120. Our total staff, including contract workers numbers 200, and the figure is expected rise to more than 300-350 in five years' time. This is a relatively large increase. In the future, we will be involved in the ERS-2 mission and primarily, in the polar platform missions. The polar platform, which is a much larger project, will really set the pace for the center and this will therfore lead to a significant improvement in both production and quality. ESRIN will be in charge of managing the data from the ESA's polar platforms for Europe and as well as the data from the American and Japanese platforms.

SPAZIO INFORMAZIONI: As far as the economic aspect is concerned, will the Frascati center receive more funding?

Roscian: Our current funding will allow the center to complete its work program. This program, which covers the 1988-92 period, envisages funding for the construction and installation of facilities. From 1993 on, the ESA board will have to approve another program with a considerable increase in funding.

SPAZIO INFORMAZIONI: What are ESRIN's contacts with the Italian Space Agency?

Roscian: We cooperate very closely and meet regularly to discuss the future of the center, to study areas of common activity, and to combine our efforts.

SPAZIO INFORMAZIONI: Italy often complains about the lack of Italian personnel in the various ESA centers. How is the situation at ESRIN?

Roscian: It is difficult to provide an accurate answer without referring to specific figures. ESRIN's staff is 50 percent Italian and I am the only non-Italian in the senior staff. Even all the higher ranks are Italian. In fact, the proportion of Italians in ESRIN is too high, and this does not give the center the strong European dimension that it should have. ESRIN should not become an Italian center, it must remain European. However, ESRIN is still a rather young structure and more non-Italians will

be attracted once the system is fully established. Furthermore, this is not a large city and therefore there are many incoveniences, even for families. Practical, rather than political problems, therefore, contribute to bringing about this situation.

Germany: Hypersonic Technology Impact Assessment Published

91MI0047 Bonn TECHNOLOGIE-NACHRICHTEN PROGRAMM-INFORMATIONEN in German No 480/481, 10 Oct 90 pp 1, 18-28

[Text] The aim of this study was to present the "state of the art" reached in Saenger space transport system research program. It was also designed to sketch out problem areas where the experts concerned see a need for technology impact assessment.

The study was carried out by the VDI [Association of German Engineers] Technology Center for Physical Technologies (VDI-TZ) and drafted by Dr. A. Zweck on behalf of the FRG Ministry of Research and Technology.

The topic was structured on the basis of the publication listed in the bibliography. On this basis, the theme was split up into the aspects listed and a questionnaire was drawn up as a basis for discussion with the experts. The experts interviewed were: Dr. Albers, MTU [Motoren- und Turbinen-Union], Munich; Professor Grassl, Max Planck Institute of Meteorology, Hamburg; Professor Hirschel, MBB [Messerschmidt-Boelkow-Blohn], Munich; Dr. Kuczera, MBB, Munich and Professor Weyer, DLR [German Aerospace Research Institute], Cologne. One problem for technology impact assessment research stood out particularly here: It was difficult to find experts who were specialists in this field yet were not involved in the overall Saenger program.

[passage omitted]

VI Summary of the Interview with the Experts

1. Technical Aspect

Technical Feasibility of the Saenger Concept

The decisive argument in favor of the Saenger concept being in two stages was considered to be that, unlike the single-stage version, this concept can be completed within the time frame dictated by the subsidy program. It was indicated that, at the current stage of technological development, unforeseeable difficulties could arise in creating a single-stage launch vehicle combining the necessary size of the unit with the reentry stress on the whole system. The overwhelming advantage of the two-stage design is thus seen in the specialized layout of the upper and lower stages for specific phases of the mission, which makes for considerable simplifications in materials and construction methods and raises expectations that the projected better cost-benefit ration may be achieved.

A further argument in favor of two stages arises out of the desire to use a launch site in Europe. A single-stage launch vehicle would necessitate a stopover landing near the equator to place the payload in geostationary orbit. With a two-stage launcher, range flight only influences the lower stage payload. The lower stage in turn is so designed to enable Horus or Cargus as well to reach the equatorial area well within its flight range. In fact, if a non-European (equatorial) launch site were chosen, the Saenger concept would have to be revised.

The greatest development thrust to be achieved under this program is identified in phases I and II. Although the basic technological work, calculations, and materials research must be completed in phase I, the first opportunity to test the requisite technology and materials in realistic conditions will arise when a viable experimental flight test launcher is built. The chief technical difficulties and delays, if any, are thus foreseen in Phase II.

Reliability

All the experts interviewed saw the achievement of the Saenger concept as a considerable contribution to increased reliability for manned space flight. From a technical point of view, it was argued that, in principle, a horizontal takeoff, aircraft-like vehicle embodies a lower danger potential than a vertical lift-off rocket system. In this respect, the redundancy that can be achieved with Saenger was mentioned, special reference being made to the number of engines: Failure of a minor part of the engines does of course lead to cancellation of the mission in question, but not to the total loss of the system, as happens with vertical lift-off systems. It was also argued that the philosophy of recoverability and the consequently increased investment in development technology also has a positive effect on overall system reliability.

A further argument is that the higher flexibility of the Saenger system as compared with conventional systems makes for a wider launch slot. This means that minor launch delays due to weather or technical problems do not necessitate postponing the launch to a new launch slot.

Safety

No increase in safety risks was envisaged in operating the Saenger spacecraft from European airports. The hydrogen technology (hydrogen production, transport, and infrastructure) needed for Saenger is already considered technically feasible, although precise notions as to whether the hydrogen should be transported to the

launch site (by pipeline or tanker trains) and then loaded, or produced on site.

The argument that hydrogen technology would involve a greater risk potential than conventional fuels was weakened by reference to American studies that demonstrated that hydrogen is no more dangerous a fuel to handle than the kerosene fuel currently in standard use in space travel.

The fear that installing an additional fuel infrastructure hydrogen alongside kerosene) might at least create an increased safety risk was considered unfounded as hydrogen technology will already be in widespread use for normal aircraft by the time Saenger enters service as a spacecraft (2010). The experts therefore considered questions about the hydrogen infrastructure as largely unproblematic.

Spaceports

The experts interviewed were of the opinion that two spaceports should be built for Saenger in Europe. In addition to political uncertainties regarding possible extra-European launch sites in the year 2010, the central argument is based on the fact that Saenger needs an intensive technical infrastructure. Using extra-European Launch sites would detract, to say the least, from the Saenger project's decisive objective—a considerable reduction in transport costs—as equipment would have to be transported at great expense from the industrial centers concerned, and the requisite infrastructure would have to be created.

The experts believe that the main spaceport should be situated on the Mediterranean, or better still the Atlantic coast, as far south as possible (so probably in Spain or Portugal). If the launch takes place over water, both disturbance to householders near the spaceport and the supersonic bang could be minimized during range flight or the ascent phase.

The charge that launching Saenger from a European site might require a reduced payload because of the range flight required to the equator (or at least to the 28th parallel), for example when placing a satellite in geostationary orbit, was refuted. Saenger has from the very start been designed to take a specific payload from a European site into geostationary orbit. The extra fuel needed for range flight to the equatorial region is negligible.

A second launching and landing site is planned for security reasons. One suitable location would be on the North Sea. If the FRG were to succeed in winning leadership of the Saenger project, a spaceport there would also provide a test site for the experimental flight test launcher in the FRG.

Apart from the hydrogen technology infrastructure described above, the difference between the spaceport and modern airports is negligible. Certainly, it must be borne in mind that considerable mission preparations may be necessary before some launches, depending on the payload. The requisite infrastructure is costly and needs considerable space. The length of the runways of today's major airports is considered sufficient. One idea might be to convert a military airport that might be out of use by then. The considerable, intensive preparations for a Saenger launch would make a normal commercial airport unsuitable for this purpose.

Saenger is not expected to pose air traffic control problems, first, because launches will be infrequent (once to three times a month), second, because the flight paths would be routed toward the open sea (outside traditional flight paths), and third, because most of each mission would be carried out above the altitude of traditional flight paths. Furthermore, it was argued that four-dimensional air traffic control which will be the norm by 2010, will make it possible to incorporate a Saenger launch into the automatic control system without any problem.

Cargus/Horus-Saenger as a Combined System

The experts saw prospects in the near future for a fully recoverable system for the Saenger-Cargus system planned alongside the Saenger-Horus system. Financial considerations rule out the development of an independent vertical lift-off transport system for payloads of the same size, as the horizontal launch system offers the cost advantages described above.

A further crucial argument in favor of the Saenger-Cargus system is that faulty or recuperable systems can be salvaged, which, in the long term, makes for a reduction in the cost of launching and maintaining satellites.

Hypersonic Aircraft

The experts indicated that their specialties or firms were currently engaged in no developments that could be seen as relating to a hypersonic aircraft. They believed that it was still too early to discuss prospects of this kind. Furthermore, as far as they knew, estimates of the demand for a hypersonic aircraft were still so contradictory—some mentioned 60 aircraft and others 500—that any budgeting would also be unrealistic as yet. They indicated that it would take about ten years to develop a Saenger hypersonic aircraft from a finished Saenger lower stage. Although the Saenger lower stage provides the basic body, the very high safety requirements laid down for civil air transport would necessitate a great many additional developments, and, with Saenger only in the technology phase at present, it is still too early to assess their feasibility.

Numerous passenger discomforts were cited as a decisive disadvantage of hypersonic technology for passenger transport: It is open to question whether this sort of aircraft could be built with windows; yet passengers may well be unwilling to fly without these.

The time it would take for the aircraft to cool down would lengthen waiting times on the ground, both for aircraft maintenance and prior to passenger disembarkation. As quasi-hypersonic flight (Mach 3 to 4) makes ground times decisive, especially for the economic operability of hypersonic aircraft, they could only be used on very limited routes. This kind of hypersonic aircraft would thus be unsuitable for the normal transatlantic routes. Flights from Europe to Australia, the Far East, South America, and maybe the west coast of the United States would be feasible. A further problem could arise if the seriously overheated aircraft had to be ditched in an emergency. This kind of question would be likely to cause considerable problems when the aircraft came up for certification.

2. Scientific and Technological Aspects

Considerable spin-offs for power, automobile, aeronautical, and chemical engineering and cooling technology can be expected even from Phase I of the program, though they will increase when new technologies and materials are applied in Phase II. Experience gained in handling hydrogen should also affect other areas. Despite the very specific nature of the technology developments necessary for Saenger, the program is providing a direct thrust for development, especially in materials sciences and engine building. An important spin-off effect can be expected from the development of light materials with high heat resistance. The materials and processing techniques required for Saenger could make for lighter aircraft engines, for example. This would reduce fuel consumption and, therefore, environmental pollution caused by aircraft.

The knowledge that will be gained for pure and applied sciences from building the Saenger is several times greater than from building a vertical launch system. Nevertheless, Saenger and Hermes/Ariane should not be regarded as alternative developments: Saenger rather represents the logical follow-up development to the Hermes/Ariane system. Hermes can thus be seen as the flight test launcher for Saenger/Horus. What is new about the Saenger concept is that it avoids developing further "throwaway technology"—with the susceptibility to failure inherent in vertical lift-off systems—and uses new methods to achieve considerable reduced transport costs for future space travel.

3. Economic Aspect

Competitiveness

The experts expect the implementation of the Saenger concept to improve the FRG's competitiveness substantially both inside and outside Europe and—if it becomes a joint European program in Europe's competitiveness worldwide. This increased competitiveness will derive from both the technical know-how acquired and the prestige gained with this kind of project.

The fact that the technology phase is already arousing extensive interest on an international level is demonstrated by publications in specialized journals in the United States that quote the Saenger project in an attempt to warn policy-makers that America risks losing it leading position in this field of technology.

No other existing or currently conceivable air or spacecraft project is expected to impart a development thrust on the same broad front and provide the associated far-reaching competitive lead as the Saenger project.

One expert mentioned a project for developing a civil aircraft engine with a low level of both emissions and fuel consumption as a program that would be equally demanding and far-reaching in its consequences. However, he stressed that a program of this type would only make sense and be of interest if it were coupled with Saenger.

Reducing Costs

The following factors point to a cost reduction per payload in comparison with Ariane/Hermes:

- Cost reductions on technical grounds bought by the horizontal launch system;
- Reduced safety risk, thus lower incidence of breakdown and lower insurance costs;
- Launching in Europe makes for few logistic problems;
- Smaller ground staff than with vertical launch systems.

An overall reduction in transport costs per kilogram of payload to about 20 to 25 percent is expected, along with a reduction to about ten percent in costs per launch. Precise comparisons between Ariane/Hermes and Saenger cannot be made yet, as Saenger is still in the technology phase. Completed systems are compared in all cost calculations. Research and development costs are not taken into account when system comparisons are calculated.

Job Creation/Labor Force

The universities will provide enough qualified employees in the coming years (provided this becomes an international joint program). This is also on the basis of the four special research fields already started up by the DFG [German Research Association], (Rhine-Westphalia Technical University in Aachen, Technical University of Braunschweig, Technical University of Munich/FRG Military University, University of Stuttgart). One problem is currently seen in the fact that many highly qualified graduates in aerospace engineering are snapped up by high technology firms that are either uninvolved or only indirectly involved in aerospace engineering. Both the number and the distribution of the jobs that the Saenger project may create in the FRG are difficult to predict. Very rough estimates put the figure at about 200 to 300 employees for Phase I (whose limits are very difficult to define). For Phase II, estimates covering all the participating countries range

from several thousand to several tens of thousands, including jobs linked to the main contractors via subcontracts. In this respect, it should be noted that part of these jobs could be covered by employees who would otherwise lack sufficient prospects, owing to the surplus military research and development capacity that may become available in coming years.

The complete Saenger system requires a smaller operating staff than today's vertical launch systems (Cape Canaveral employs about 6,000 people); estimates run to about 600 employees.

The experts were unable to say what percentage of the expenditure incurred under the subsidy program will be allocated to small and medium-sized enterprises. Nor could it be predicted in which regions of the FRG the jobs would be located. Mention was made of the southern German, Bremen, and Hamburg regions in view of the current distribution of aerospace firms in the FRG. One of the experts interviewed said that there was a lack of specialized staff in North Rhine-Westphalia, especially in the fields relevant to aircraft and spacecraft construction. This fact can be traced back historically to the strong subsidies given to coal mining, which hampers workforce reorientation and structural changes toward promising new technologies in this region. Decisions about the future location of DARA [German Space Agency] are of crucial importance in this connection.

Establishing Demand

Expert estimates as to how many Saenger units will be built range from two to five. Extrapolated demand estimates point a considerable increase in payloads to be transported into space; this will guarantee capacity use for a cost-effective transport system.

Concrete projects that could be carried out with Saenger cannot be formulated at present. Alongside the large payload capacity of Cargus and the opportunity for manned European space flights, the possibility of and urgent need for payload recovery and transport back from space were highlighted. In principle, recovery transport is also feasible with Hermes/Ariane, but only Saenger's low mission costs will make return transport from orbit an economically viable proposition.

Hypersonic Aircraft

Precisely because the estimated demand for a fleet of hypersonic aircraft varies widely, the experts saw no realistic market, the more so because the development of an aircraft of this type would currently be limited by numerous financial obstacles. At the earliest, this situation cannot change until the experimental flight test launcher has been completed, or, to be on the safe side, until the Saenger's lower stage has been completed. A decision for or against constructing a hypersonic aircraft from the Saenger lower stage is considered before the turn of the millenium. A "Superconcorde" project, for cruising speeds of about Mach 4, is being discussed at this moment because Concorde is scheduled to go out of service around the year 2000. All expectations are that the FRG would not initiate a project of this type although France, and possibly Great Britain, might. No FRG participation in a "Superconcorde" project is foreseen, as France and Great Britain's work on Concorde already gives them a clear advantage in know-how. This is the reason why the FRG decided to push hypersonic technology (much greater than Mach 5). French technological lead in this field can be ruled out. If a Superconcorde of this kind were to be developed, any development of a hypersonic aircraft from the Saenger's lower stage could be practically ruled out. Some of the experts also raised questions of fundamental nature in this connection. It was asked whether society even aspired to the development of a hypersonic aircraft. Other problems, such as world hunger, the greenhouse effect, and the North-South divide could lead to a completely new definition of high technology projects in future. A Japanese project to convert CO_2 into methanol by cooling as a means of increasing energy yield while at the same time decreasing CO_2 emission, was cited as an example of this kind of future-oriented research project.

4. Ecological Aspect

Noise

The noise emissions from a Saenger spacecraft may be classified under two headings:

- Noise generated during launching (in the vicinity of the launch sites);
- Sonic boom.

In principle, noise abatement issues can be addressed during design of the integrated dual engines. The experts differed over the phase of the project where this kind of question actually finds its way into the development work. They explained that noise emissions are not a primary consideration when an engine is designed. MTU [Motoren-und Turbinen-Union] is currently conducting a military aircraft program that covers noise abatement. Saenger noise emission estimates ranged from a level comparable with the noise generated by passenger aircraft in the sixties (during take-off, the integrated dual engines would work as conventional turbojets without afterburners) to the forecast that Saenger missions would be undertaken only once or twice a month.

Launch sites would not be situated in densely inhabited areas and, as already mentioned, launches would be carried out over open water as far as possible.

In principle, the Saenger's external shape could be adapted to affect the aircraft's noise emission. The extent to which this was taken into consideration when designing the Saenger was not made entirely clear.

In any case, it was stressed, noise emissions from any hypersonic aircraft should meet present or future standards governing aircraft.

This was an obvious condition for the success if any hypersonic aircraft project.

Sonic boom was not considered to be a problem for hypersonic aircraft if the flight paths are routed over water. Limiting possible flight paths on this basis for hypersonic or supersonic aircraft decreases their productivity by 10 to 20 percent. Hypersonic cargo flight over land was ruled out by most of the experts. It was also pointed out that the high speeds cause very markedly wedge-shaped shock waves to develop, which leads to a decreased noise pressure on the ground, because of the high altitude of the aircraft, which means that the sound waves take a long time to reach the ground.

Gas Emissions (Water Vapor and NO_x)

The experts interviewed did not expand on the explanations given in Chapter 5. It was emphasized that there is insufficient knowledge of atmospheric chemistry—especially in the upper strata of the atmosphere—to evaluate the effects of the Saenger's emissions (both H_2O and NO_x).

No accurate data is currently available about the precise extent of and potential for reducing the NO_x emissions (by nitrogen oxidation in the combustion chamber or exhaust jet and by gas kinetic effects). In any case, nitrogen oxidation in the combustion chamber is responsible for the majority of NO_x emissions. NO_x emissions have not been included in the models in the technology work done to date. The present phase focuses primarily on fundamental technical feasibility. However, the question of whether NO_2 emission can be reduced will be addressed during further development of the Saenger.

The emissions that can be expected from two Saenger flights per month are probably not of great ecological significance. It was also denied that Saenger's emissions might be greater than those of a vertical lift-off system because of its horizontal cruise and consequent longer time spent in each individual atmospheric layer. What actually has to be compared here is the quantity and quality of the emissions per unit of height gained. Nevertheless, the fact that lower transport costs for space transport may considerably increase the demand for and, consequently, the use of space transport systems should be taken into account. Care should thus be taken in future to ensure that any ecological advantage over other propulsion systems (see below) should not be eroded by an ever-increasing frequency of launches.

Saenger's emissions are lower and less harmful than those of solid fuel rockets, especially in the troposphere. If detailed studies were to demonstrate that Saenger's emissions caused considerable environmental damage, the crucial question, in the subsequent assessment would not be whether Saenger is possible, but whether space travel can be justified at all. Its reduced fuel consumption as compared with vertical lift-off systems already makes Saenger a less risky space project from an ecological point of view. This statement must be qualified by the fact that, with launch systems that do not take in oxygen by breathing air, but take it with them in a tank, NO_2 emissions occur as a waste product of nitrogen oxidation in the combustion chamber, which, as has already been emphasized, accounts for the vast majority of all NO_2 emissions. There is no precise basis for comparing fuel emissions: solid fuel (NH_4Cl_4), hydrazine/O_2, kerosene/O_2, H_2/O_2, H_2/air-breathing O_2. A precise knowledge of the quantity of emissions per mass of payload is essential for evaluating the various systems from an ecological point of view.

The detailed research into the impact of the Saenger's emissions clearly demonstrates the urgent need for an assessment of the consequences of the technology.

A knowledge of the basic principles of atmospheric chemistry and the possible effects of Saenger emissions (e.g., effect on the ozone content of various strata of the atmosphere) is essential to any decision for or against developing a hypersonic aircraft. It is to be expected, however, that a larger number of hypersonic aircraft and a high mission frequency would give rise to a considerable level of emissions. If it cannot be demonstrated that these emissions are innocuous (especially for the ozone layer and as regards the greenhouse effect enhanced by water vapor emissions in the troposphere), the development of a hypersonic aircraft can hardly be accepted by the public and is therefore not a viable proposition.

Some experts stressed the urgent need to intensify research into the ecological consequences of air traffic. In a way, as some experts explained, it is pointless to agonize over two Saenger launches, while the air traffic that now reaches every corner of the globe threatens to alter the whole atmosphere. As far as the greenhouse effect is concerned, it is true that air traffic is responsible for only one or two percent of overall CO_2 production. However, the question is whether we can afford to ignore the other emissions. If we consider that about 1.25 tonnes of water vapor are generated per tonne of kerosene and that the greenhouse effect of a water vapor molecule emitted at an altitude of 12 kilometers could be several times greater than that of a water vapor molecule released near the ground, this would mean that air traffic bears a considerably larger share of responsibility for the creation of the greenhouse effect.

It is important for studies on this topic to have a measurement aircraft to fly behind other aircraft (especially at altitudes of over ten kilometers) and observe the effects of the emissions "on the spot."

At the moment, Professors Crutzen, Grassl, and Klei have access to IABG [Industrial Plant Operation Corporation] estimates of Ariane, Shuttle, and Saenger emissions, which are used as the basis for the following studies: Professor Crutzen is carrying out calculations. Professor Grassl is studying radiation transport models that will pay special attention to water vapor in the higher atmospheric strata. Professor Klei is investigating the retention times of water vapor molecules as a function of altitude and geographical extension and height.

This is the only way to find out more accurately how water vapor emissions influence the greenhouse effect. Professors Crutzen, Grassl, and Klei are also working together on investigating the portion that aircraft NO_x emissions represent in the overall NO_x pollution of the lower stratosphere. Research efforts in the United States are also reported. NASA has published a call to participate in a research project under the Office of Aeronautics and Space Technology's high speed research program, the aim of which is to achieve a fundamental understanding of the effects of aircraft flying in the stratosphere.

Other emissions

No other residues are expected, apart from the emissions already named. This can be regarded as an argument in Saenger's favor, to the extent that all traditional launch systems contribute to an increase in the scrap in space. As mentioned in Chapter I, there are currently prospects for developing a fully recoverable Cargus/Saenger system as well.

Exposure to Radiation in Hypersonic Aircraft

The experts were not unanimous as to whether the flight crews of any future hypersonic aircraft would be subjected to substantial radiation exposure due to the great cruising altitude. However, it was indicated that should this kind of problem arise, suitable protective and remedial measures could be taken.

5. Social Aspect

No substantial social repercussions are expected from the Saenger space project. The experts' comments on the social aspect were therefore limited to the acceptability of the project.

The experts anticipate no acceptability problems, neither in the vicinity of the launch sites, nor in terms of the general implementation of the project. Nevertheless, it was expressly emphasized that as wide a social consensus as possible was a precondition for the long-term implementation of a project. This consensus required that the population be informed as far as possible about this kind of project. In this respect, the experts identified a clear shortcoming. The argument that the Saenger project had only just started and that this was why no serious public information campaign had yet been undertaken was not considered valid, as other projects on which work was already more advanced, such as Ariane or Hermes, had also had insufficient public exposure. France was quoted as a model of intensive public information work: Regular television broadcasts on space travel have heightened the awareness of the French public. Some experts wondered whether anyone in the FRG, if asked: "What do you think about Saenger?" would be able to say anything other than: "Saenger? What's that?"

Hypersonic Aircraft

There are currently no indications as to the cost of passenger transport with hypersonic aircraft. When the time comes to decide for or against hypersonic aircraft, this question will have to be answered clearly. It is to be expected that passenger fares may be higher, and this may create opposition to a Saenger project of this kind on the grounds that public funds should not be used to finance a hypersonic aircraft that would benefit only a small number of financially better-off people.

Acceptability problems may arise out of frequent hypersonic aircraft take-offs and landings at commercial airports, because of both the noise the aircraft generate and the suspected risk potential that a hydrogen-fueled aircraft may represent. The experts believe that the noise problem will be solved by developing engines that meet future noise protection standards. American studies and estimates were mentioned in reference to the hydrogen risk potential. These indicated that a hydrogen-fueled aircraft would represent no greater risk potential than one fueled with kerosene. However, no precise data on comparisons of this kind could be obtained in this connection.

6. Political Aspect

Achieving Project Coordination

The Saenger program's incorporation into the ESA [European Space Agency] (in about 1993), is as a considerable contribution to guaranteeing the FRG a leading position in space engineering in Europe.

European Cooperation

If, as expected, Germany is appointed to coordinate the Saenger project, it would be guaranteed a leading role alongside France in European space technology for the next decade.

Saenger is seen as an opportunity to transform the current French leadership into an equal partnership, which will of course continue to be weighted toward particular projects. Fears were expressed off the record in this connection: As it normally does in its space projects, France is currently working in great secrecy on a hypersonic project of its own. France suddenly turn up at ESA with a proposal for a single-stage horizontal launch system, backed up by the availability of the Kourou launch site.

History has shown that France and the UK only achieve their current leadership in some areas of technology by carrying out projects of this

kind continuously. France in particular has moved to the forefront as a result of the long-term orientation of the space projects it has carried out. It was mentioned that the FRG had often lacked the vigorous political continuity that this required.

The decisive feature of the Saenger project is that, unlike numerous space projects in recent decades, the FRG has not just taken part and left the bulk, particularly the design work and the success, to France. Provided this project's "political stamina" lasts, German leadership of the system will attract most of the credit and have a positive effect on high-tech German industry. Asked which parts of the Saenger project the FRG should secure for itself, the experts answered: all the areas that France kept for itself in the Hermes and Ariane projects.

Another positive aspect emphasized was that, as well as putting the partners on an equal footing, European integration in this project would also promote cooperation in technological, political, and economical fields.

There is currently no technical impediment to the FRG carrying out the Saenger concept alone. This is in fact the precondition that a project coordinator must be able to meet. The coordinator must be competent in all aspects; this is the only way for project coordination to work.

From a financial point of view, however, the FRG should not consider the possibility of going it alone into Phase II of the program.

International Cooperation

The question of whether cooperation should be exclusively European was left open. International interest in the Saenger project had already been aroused in any case, which meant that an important aspect of the current technology phase had already been achieved. It was also conceivable that the cost framework for Saenger would be so high, even if the European states were to participate, that additional international cooperation would be needed to guarantee the project financially.

One crucial political aspect is that Saenger would give Europe its own, largely autonomous access to space in the next decade. This would also lay the foundation for European participation on equal terms in future international joint projects. The high costs would probably rule out parallel developments, so it is more likely that projects focusing on different aspects, though still falling under an overall concept, would be carried out by the United States, the Soviet Union, Japan, or Europe.

7. Evaluation of Possible Impediments and Technology Impact Assessment Issues

In brief, none of the experts saw substantial impediments to or arguments against the Saenger concept. There may well be room for reflection about the extent to which a society in principle needs space travel and whether there may be social conditions—and if so, which ones—that would make it preferable not to force space development any further. In this connection, the opinion was aired that mankind is trying to explore space, just as it tried to explore land and water in the past. One expert stressed that, in his opinion, it would not be difficult to find plausible reasons for space travel in the future either. Both earth reconnaissance, especially for ecological and food technology reasons, and satellite communications were future-oriented. Space reconnaissance was also a strong argument. On the other hand, it might become difficult with prestige projects such as manned space flight. The investment bore no justifiable relationship with the output. Robotics already provided more cost-effective alternatives.

The following points were underlined as important criteria in favor of the Saenger project:

- flexibility;
- recoverability;
- reduction in transport costs;
- no increase in structural scrap;
- faulty systems or those due for maintenance can be recovered cost-effectively from orbit;
- increased safety/reliability;
- stimulus to technology on a wide front;
- buildup of technical competence, to put the FRG on an equal footing with France in aerospace engineering;
- enhancement of the FRG's international competitiveness;
- contribution to Europe's technical and economic self-confidence and thus also to European integration.

Issues Pertinent to Technology Impact Assessment (Saenger Space Project)

The need for a more accurate knowledge of the chemistry of the atmosphere and the consequences of NO_x and H_2O emissions, with particular reference to the possible destruction of the ozone layer and the worsening of the greenhouse effect, was unanimously considered the most pressing question. Without this knowledge, space travel as a whole risked falling into public disrepute in the long run. The argument that low launch frequency would mean that any environmental damage caused by space travel would only be marginal could probably not be conveyed as a certainty. Broad-based social acceptability for space travel could only be ensured if possible climatic and health effects could be largely ruled out.

The Saenger's incorporation into future European and international space programs would also affect future decisions on space travel. A European space travel scenario and its repercussions could conceivably be sketched out in this connection.

Further points in the questionnaire that are still open are:

- What international consequence can be expected from cheaper access to space? (Should we expect greater, easier exploitation of space to lead to political polarization?)
- How would the completed Saenger project (under FRG coordination) affect European integration?
- How can the earliest possible transfer of technology from the Saenger project to other fields be ensured?

Another opinion mentioned with the same frequency was that it was too early to investigate the consequences of technology at a time when we were just starting to put together a clear idea of what actually had to be done.

Issues Pertinent to Technology Impact Assessment (Hypersonic Aircraft)

No development prospects were currently seen for a hypersonic aircraft. As nobody in the FRG had yet made a detailed study of a hypersonic aircraft, the impact that the technology might make could not be assessed here. At least an approximate idea of the technical achievement that this would involve would be needed before its effects could be studied, but this question had not yet even been clearly formulated.

In any case, a hypersonic aircraft posed numerous questions.

Ecological issues—about 20 Saenger space shuttle launches a year were not considered a great risk potential—were judged a problem if large numbers of hypersonic aircraft were to begin cruising permanently through the atmosphere. If it could not be ruled out that hypersonic technology might represent far reaching environmental hazards, the only option would probably be to cease the development and use of hypersonic aircraft once and for all.

Questions of noise, both in the vicinity of airports and due to supersonic pressure shock, are also relevant to a hypersonic aircraft. Noise reduction to the maximum values allowed for conventional aircraft is a precondition for this kind of project. Supersonic pressure shock problems can only be solved by routing flight paths exclusively over water.

Furthermore, hypersonic aircraft acceptability questions are also relevant: To what extent are public subsidies for this type of project feasible and desirable? One criticism, if the fares were high, might be that only a small minority would be able to use the hypersonic aircraft.

Questions concerning the technical feasibility of a hypersonic aircraft under the marginal conditions that it would presumably have to have windows for passenger flights and that economic reasons would dictate that it could only have short turn-around times on the ground maintenance times, i.e., it would have to cool off quickly for ground handling, remain to debate. There is also at present absolutely no answer to questions concerning as sudden accidental loss of pressure in a hypersonic aircraft at great cruising altitudes.

Nor has there been any answer yet to the economically relevant question about whether there would ever be sufficient demand for this kind of aircraft considering its high development and maintenance costs.

The following questions also remained unanswered owing to the fact that the image projected of a future hypersonic aircraft was still vague and uncertain:

- Possible consequences of an increase in air traffic due to the existence of a hypersonic aircraft.
- Possible consequences of high maintenance and procurement costs for a hypersonic aircraft.
- Questions concerning the number and type of jobs involved in hypersonic aircraft construction.
- Social, cultural, and economic consequences of the shorter time required to reach distant destinations.
- Psycho-social and cultural consequences of increased mobility.
- Questions of any conceivable exposure to radiation, especially of flight crews, caused by the hypersonic aircraft's high cruising altitude.
- Comparison between the potential hazards represented by hydrogen-fuel powered hypersonic aircraft and kerosene-powered aircraft.

VII Recommendations

1. Saenger Spacecraft

The central result of this preliminary study is that research into the effects of the Saenger's emissions is the most pressing task in the assessment of the impact of this technology.

The following ecological problem areas sketch out the research required for technology impact assessment:

- Creation of a better, solid basis of knowledge about the chemistry of the individual strata of the atmosphere;
- Scale of the Saenger's NO_x and H_2O emissions (especially in comparison with these and other emissions from other space systems);
- Effect of the temperature increase and pressure shock caused by Saenger on the dissociation equilibrium of NO_x/NO_2, O_2, O_3/O_2; HO radicals (in comparison with other space systems);
- Investigation or preclusion of the effects of these emissions on the natural chemistry of the atmosphere and possible consequences for the climate and the environment.

The following additional questions about the Saenger project also arose, though with considerably less priority; they could also be of interest for an ongoing technology impact assessment:

- How would a long-term European space scenario look and what political and economic consequences would it have?
- What would be the consequences of intensified space travel made possible by the reduction in costs?
- How will the Saenger project affect European integration?

2. Hypersonic Aircraft

The experts interviewed stated unanimously that there is no move or plan at the moment to develop a hypersonic aircraft. Because a fleet of hypersonic aircraft would release considerably more emissions, which may entail serious consequences, it was recommended that a sure knowledge of the ecological problem areas listed item 1 should be considered as a precondition for any planning or preliminary decisions in the direction of a hypersonic aircraft. Furthermore, many questions and problems posed by hypersonic aircraft could neither be precisely formulated, nor could their relevance be assessed in brief at the present time because no one has even an approximate idea of a project of this kind, and these questions remain unanswered. In any case, further preparatory technology impact assessment measures will be needed as soon as the first plans for a hypersonic aircraft are considered.

3. Concern Expressed by the Experts

Going beyond the results of the technology impact assessment work as such, the experts are of the opinion that an intensive public information campaign should be undertaken to enhance the plausibility of the Saenger project's aims. A broad-based social consensus is of special importance because the FRG is expected to be the coordinator of the European Saenger project. In particular, the information campaign should differentiate clearly between the two main technical goals, one being a spacecraft and the a hypersonic aircraft. This is the only way to weaken the widely held opinion that the BMFT is subsidizing the development of a hypersonic aircraft.

AUTOMOTIVE INDUSTRY

EC Backs Clean Car

91WN0205X Paris LES ECHOS in French 24 Dec 90 p 6

[Article by Jacques Docquiert: "The Twelve Impose the Clean Car"; first sentence is LES ECHOS lead]

[Text] Accused of having neglected the environment during its presidency of the EC, Italy has countered these criticisms by having the EC ministers approve a series of important directives on the automobile.

Brussels—The European environmental ministers have decided that, beginning in 1993, medium and large displacement engines will be required to meet antipollution standards as strict as those already in force for small capacity engines. As a result, when the single market goes into effect, the fleet of cars produced and operating in the EC will be cleaner. By the end of 1992, the Commission will issue new proposals strengthening these standards in light of technological advances made in the interim.

According to Carlo Ripa di Meana, the European commissioner responsible for environmental issues, "These decisions allow Europe to make up for the time lost by the automobile industry," which, he said, "is positioning itself on the leading edge of the world market." The commissioner added that he now intends "to tackle the clean truck" by submitting standards for large trucks, before going on to consumption and speed limit problems.

The new standards for "acceptance" (approval of new models) have been set at 2.72 g/km for carbon monoxide emissions, 0.97 g/km for hydrocarbon and nitrogen oxide emissions, and 0.14 g/km for particle emissions. For "production compliance," these standards are 3.16 g/km, 1.13 g/km, and 0.18 g/km, respectively. They are effective as of 1 July 1992 for new models and 31 December 1992 for new cars. Given the current state of the art, they will mean that automobile manufacturers will be required to equip cars that have an engine capacity of over 1,400 cm^3 with three-way catalytic converters.

The ministers also agreed that, by 31 December 1993, they will take a majority decision on the stricter standards proposed by the European Commission one year earlier, in order for these standards to be able to go into effect 1 January 1996. Effective immediately, member states wishing to do so may use tax incentives to encourage the purchase of clean cars that meet 1993 standards.

EC Announces CFC Countermeasures

91WN0205Y Paris LES ECHOS in French 24 Dec 90 p 6

[Article by Jacques Docquiert: "EC To Eliminate CFC's"]

[Text] The European Council has committed itself to eliminating the CFC's (chlorofluorocarbons) that are depleting the earth's ozone layer by 1 July 1997. Already last June, the EC had ratified the amended Montreal protocol providing for the elimination of CFC's by the year 2000. As of 1 July 1995, use of these substances will be cut by 50 percent. Lastly, France has asked the Commission to draw up a CFC tax plan to finance the recovery, recycling, and destruction of these substances, which, while for all practical purposes no longer used in aerosols, are still of importance in refrigeration equipment.

The ministers also approved a new "hazardous wastes" directive defining these wastes more precisely than the

first framework regulation last June. Authorization procedures are stipulated for companies processing hazardous wastes, with authorization still optional for those that collect and transport them.

Lastly, in order to protect the environment in the Mediterranean region, the Council has decided to launch a specific program dubbed "MEDSPA" [expansion not given]. The program has a budget of 25 million ecus (175 million francs) for 1991 and 1992 and, in 10 years, should contribute to improving the environment of one of the Community's most polluted regions.

France: Robot Improves Renault Quality Control

91WS0056B Paris L'USINE NOUVELLE/ TECHNOLOGIES in French 18 Oct 90 p 21

[Article by Bernadette Lacaze: "Accelerated Robotized 3D Control"]

[Text] **Using the DEA robot, the Renault Cleon plant divides by 3 the time it takes to control castings of 21 different models.**

Conveyed automatically, the cylinder case positions itself between the arms of the DEA measurement robot. After identifying the part to be checked by mechanical scanning of coded-height studs, the two measuring heads start working on opposite sides of the part. It will take them 15 minutes to scan the 500 points programmed and to provide a printed list of the results and a comparison with permissible tolerances.

This equipment, costing 3.3 billion French francs, was recently installed at the foundry unit of the Renault plant in Cleon; it fully meets one of the goals set by Renault: to reduce testing time. In fact, the same operation used to take 45 minutes when it was done by the traditional method, with pins and comparators on a fixed jig. However, as Jean-Claude Barthez of the set-up department pointed out, rapidity of execution is not the only advantage of this measuring assembly. It is also more accurate and more flexible.

The control protocols are generated through programming. This method makes it possible for the system to handle both the great variety of aluminum castings used in the unit (21 for the moment) and all the modifications made as vehicles evolve. The protocols are prepared on a MicroVax minicomputer. The same workstation is also used for the processing and statistical analysis of results. "Because," Serge Boidron, in charge of foundry quality control, explained "we want to be able to adjust the process fast and adequately. Plus, we want to be able to intervene upstream (drawings and tools) in order to reduce the number of specimen parts before starting production of a component."

In its air-conditioned cubicle, the system is set up in the center of the foundry, providing easy access from all casting machines. It constitutes a perfect demonstration of the capabilities of these control means which are designed to anticipate production deviations and correct their causes as soon as possible in order to reduce rejects.

German Laser System Measures Emission in Diesel Engines

91MI0064 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 29 Oct 90 p 12

[Excerpts] Professor Juergen Wolfrum and his assistants at the Heidelberg-based Institute of Physical Chemistry are using laser technology to determine the type and location of pollutants produced, for example, by a Golf diesel engine. The "dual-frequency laser," a newly developed measuring instrument patented by the Heidelberg team, should shed new light on the sooty darkness of the diesel engine.

For the first time in the history of the diesel engine, the substances released as a result of combustion can be spotted directly inside the engine by using this laser model. The evidence gathered with this method will help vehicle designers to build diesel automobiles with reduced levels of harmful emissions.

So far tests relied solely on the analysis of exhaust gases. Direct measurements could not be carried out in the engine itself, where a pressure of about 50 bar and soot formation prevented the analysis of combustion processes.

Laser research has finally achieved the breakthrough: Light signals can now be sent inside the engine through a quartz window. [passage omitted]

The dual-frequency laser can be used to perform a detailed analysis of the chemical processes that take place inside the engine. The use of UV laser beams with two different frequencies makes it possible to distinguish nitrogen from oxygen and hydrogen radicals and also to analyze the sooty background gas mixture. The mechanism is very simple: The dual-frequency laser causes the various substances to refract light in a different way. Conclusions as to the composition of the gas mixture can thus be drawn from the resulting color spectrum.

BIOTECHNOLOGY

France/Spain: Genetic 'Trick' Produces Higher Protein Yield

91P60084P Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 15 Nov 90 p 8

[Excerpt] A group of French and Spanish scientists has developed a technique with which the yield of proteins genetically produced in bacteria cells can be significantly improved. By means of a genetic trick, they succeeded in causing the bacterium Bacillus subtilis to secrete greater quantities of the enzyme cellulase, which breaks down cellulose.

In the biotechnological production of a protein using genetically altered bacteria, one is often confronted with the difficulty that the yields of the desired product are inadequate. In order to increase these yields, many researchers are attempting to bolster the genetic control elements that regulate the rate of synthesis in bacteria. Others provide the bacteria with several copies of a gene that is to be transformed into the proteinaceous product.

First of all, the production strain of the bacterium B. subtilis exhibits small surplus chromosomes, called plasmids, which contain one or two dozen specimens of a gene, albeit rather unstably. While the bacteia are being grown in large bioreactors, the genes easily become lost and the yield of the desired product falls off.

Marie-Agnes Petit and her colleagues from the Pasteur Institute in Paris and from the Ingenasa biotechnology firm in Madrid have caused B. subtilis cells to accept foreign genes into their principal chromosomes, subsequently [allowing them to] multiply greatly within the chromosome structures. They used the gene for an enzyme which breaks down cellulose, transplanting it from the base bacterium Clostridium thermocellum into the B. subtilis production strain.

After implanting the foreign gene in the B. subtilis chromosome, they arranged for the foreign gene, especially provided with an appropriate genetic regulatory signal, to reproduce autonomously without relinquishing its place in the chromosome. In this way, the researchers obtained a production strain in which the cellulase gene appeared amongst a group of 250 consecutively linked specimens.

The cells stood up well under these manipulations. With each replication of a bacteria chromosome, they copied the augmented gene ensemble, so that all offspring of a genetically manipulated cell were armed with the same ensemble of identical cellulase genes. The unusual ensemble of genes did not perturb the biosynthesis process within the cell. The enzyme yield was four times as great as in a comparable strain having 20 copies of the cellulase gene on a small unstable surplus chromosome.

Even though the yields of cellulase have been thereby considerably increased, the follow-on efforts of the researchers are aimed at determining how much more the results can be improved—whether [or not] a 250-fold product yield can be reasonably expected.

The inexpensive production of large quantities of the enzyme cellulase could attract more interest in the proximate future. For a long time, large quantities of cellulose derived from the sugar, starch and paper industries remained virtually unused. With increasing environmental awareness, efforts are increasingly being made to use cellulases for breaking this waste product down into its constituent glucoses, in order to use these latter as raw material for the synthesis of simple organic acids, solvents or even biosynthetics.

Germany: New Technique Introduced Against Industrial Pollution

91P60094P Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 7 Jan 91 p 10

[Excerpt] At the college of technology of the Institute for Environmental Chemical Engineering in Essen, scientists have hit upon a novel technique using animal manure in a manner directly benefiting environmental protection. According to the Federal Ministry for Research [and Technology], manure can be used to render harmless the nitrogen oxides—which bind to water to produce nitric acid, a prime constituent of acid rain—in the exhaust gases of power generating stations. The new technique has been operating successfully since April 1990 in tests conducted at the heavy oil-fired steam generating plant of the Veba Kraftwerke Ruhr AG. The main idea behind the technique is to spray liquid manure into the exhaust gases of power generating stations. Since the manure contains a large amount of ammonia, a compound consisting of nitrogen and hydrogen, the hydrogen in the ammonia binds to the oxygen portion of the nitrogen oxides in the exhaust gases, producing water and liberating harmless nitrogen gas. Dust-like particles of manure are left behind; but, these can be filtered out.

A pilot plant employing this technique has thus far achieved a 60

reduction of nitrogen oxides; thus, this technique can be applied at oil- and coal-fired power generating stations rated at under 300 mW of thermal output. With additional modifications, the technique can also be adapted for use in larger facilities. The Federal Ministry for Research and Technology also pointed out the efficacy of the technique in waste incineration since the manure's nitroorganic components, apart from reducing nitrogen oxides, can also suppress the generation of poisonous dioxin in exhaust gases.

Germany: Parallel Peptide Synthesis Technique Developed

91P60083P Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Dec 90 p 8

[Excerpt] Dr. Heinrich Gausepohl of Abimed-Analysentechnik GmbH, Langenfeld, and Dr. Rainer Frank of the European Microbiology Laboratory (EMBL) have succeeded in adapting a pipetting robot and its associated components to the [process] of fully automated parallel peptide synthesis. The novel apparatus makes it possible to synthesize up to 48 individual peptides, with up to 20 amino acids, in quantities ranging from five to 20 micromoles. The new method has a potential application in the field of vaccine development where synthesizing certain peptides in the proteinaceous composition of a pathogen can lead to the

development of the corresponding vaccine, without the risk of infection which accompanies traditional methods of vaccine production.

German Institute Develops Nonanimal Drug-Testing Method

91MI0044 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 10 Oct 90 p 5

[Text] The development of alternative methods to vivisection remains a continuing scientific challenge. One of the possible models involves testing the electrical activity of nerve cells in cultures. Our behavior and physical functions are controlled by the nervous system. Nowadays, the in vitro model, as it is known, can often be used instead of animal tests to develop drugs for diseases of the nervous system. The Battelle Institute in Frankfurt has established an in vitro model in which the electrical activity of individual nerve cells and the mechanisms by which they work may be studied under specific experimental conditions. The cell cultures are grown from rat embryo brain cells. In the subsequent three to four weeks the cultures develop into a network somewhat resembling a "two-dimensional brain." The electrical activity is measured by placing a ripe cell culture in a chamber on the stage of a microscope situated in a Faraday cage. The chamber is continuously flushed with cell culture medium so that the nerve cells remain viable for many hours. Drugs or test substances can be added to the medium and their effect on the electrical activity of the cells measured.

One example of the practical application of this method: It is known that a certain class of transmitters is involved in the occurrence of pain. Thus, for example, an injury triggers the release of these neurotransmitters in the nervous system; other nerve cells are thus stimulated and relay the signal, thus creating the sensation of "pain." A pharmacological counter to this neurotransmitter, which is known as an antagonist, would block the relaying of the signal triggered by the pain stimulus; the sensation of "pain" would not occur, and a painkiller, or analgesic, would thus have been characterized. This simplified description shows how a cell culture system of this type could be used: The effect of the transmitter and the antagonists on the electrical properties of the nerve cells can be pretested on pain-free matter without tests on animals. Theoretically, only those antagonists discovered in the in vitro models would have to be tested for pain-relieving efficacy on animals. Cell cultures can be used not only to study the central nervous system, but also for research into the cardiovascular system. It is now possible to keep single cardiac or vascular muscle cells under culture conditions and study the effects that drugs exert on them. The institute believes that it will still not be possible to do away with animal testing completely. However, further development of in vitro methods will mean that animal experiments can be better planned and their number further reduced.

COMPUTERS

Netherlands: Top Range Supercomputer Installed

91AN0056 Amsterdam COMPUTERWORLD in Dutch 26 Sep 90 pp 1, 26

[Article by Wim Amerongen: "Scientific Community Chooses Cray-Super"]

[Text] Utrecht—This year, the Dutch research community is to obtain one of the most powerful computers: the Cray Y-MP4. This machine will replace the seven-year-old Cyber 205 of the computer center of two Amsterdam-based universities (SARA). A new "Foundation for Dutch Scientific Research (NWO) has been set up to manage the new supercomputer. To this end, it will be allocated a 15-million-guilder annual budget. The system will be replaced by a faster machine in three years' time.

The decision to buy the new Cray was made by the NWO's board of directors. The preparatory work was in the hands of a select committee supported by the Supercomputers Working Group (WGS) of the Dutch network for "Cooperation between University Computer Centers" (SURF).

Patrick Aerts, WGS secretary, explains: "One of the Dutch research community's most important requirements for the new machine, apart from mere computing power, was that it would operate on Unix. NEC, Fujitsu, and Cray systems were subjected to tough benchmark tests, but these revealed that the Japanese manufacturers still had an inadequate knowledge of Unix.

Costs

The WGS estimates that the annual costs of the new system will be 15 million guilders. These costs consist of four categories: In addition to the purchasing cost, there are costs for organizational work, the promotion of computational research, and, above all, for data communications.

The super's computing time will be assigned on the basis of a so-called "peer review." This means that requests for computing time will be judged by other scientists. Almost all Dutch scientific institutions have access to the supercomputer through the WGS. In addition, major technological institutes will also use the system: the Hydrodynamic Laboratory, the Dutch Nuclear Research Center (ECN), Marin, the National Aviation and Aerospace Laboratory (NLR), the Institute of Ground Mechanics in Delft, and The Central Organization for Applied Scientific Research (TNO). Doctoral candidates working elsewhere can also use the supercomputer.

Users

Users are obliged to report on their work with the supercomputer. Aerts knows from experience that working with a very powerful supercomputer can lead to surprising results. "Some users get a deeper insight into

their theory through the use of a supercomputer. It has happened that this enabled them to simplify their problem, so that work could be continued on their own systems."

Three Benchmarks

The three systems from which the selection had to be made were submitted to three benchmark tests: capability to process individual user programs; to measure throughput; and to process interactive tests. These tests showed a clear lead for Cray when it came to working under Unix. Apart from this, the Japanese machines were unable to process certain benchmarks.

Workstations

The significance of Unix to WGS is striking. Aerts explains: "To adapt Unix to supercomputers, upgrades must be made that are not included in the standard. Nevertheless, Unix is the only operating system standard for the scientific community.

"The main reason for this is that most technical workstations also operate on Unix and that changeovers must be easy. Users, however, must stick to the programming rules, so that programs remain transferable."

According to Aerts there is still a need for supercomputers. "We see that minisupers are becoming more and more powerful, yet there are programs that approach their technical limits. These can only be processed within a reasonable time frame on a real super."

Necessity

Finally, Aerts points out that the purchase of the new super means more than just the acquisition of a piece of furniture. "To stimulate scientific research in the Netherlands, it is essential to have access to the most advanced supercomputer equipment. If Dutch scientific research is to stay at the top, such a system is indispensable."

ENERGY

Germany Solar Energy Program Status Reviewed

91MI0063 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 29 Oct 90 pp 3-4

[Text] The commercialization of solar energy system is supported by the federal government and by most of the Lands which provide grants of between 25 and 75 percent. No support is provided by Baden-Wuerttenberg, Bayern and Rheinland-Pfalz. These three Lands however, like the other, fund energy-saving measures and the exploitation of renewable energy sources.

A detailed description of support programs and amounts of financial support as well as a list with the addresses of the bodies responsible for support approval (updated in June 1990) can be obtained from the German Association for Solar Energy [DFS] Hindenburgallee 1, 8017 Ebersberg, by sending three German marks [DM] in stamps.

According to DFS sources, 90 percent of West German producers of solar installations - mostly small- and medium-sized enterprises - belong to this association.

A more comprehensive and more updated overview is provided by "*Subsidy Handbook*," a book by the Karlsruhe Technical Information Center, BINE [expansion not given] project, and the Forum on Energy Sources of the Future, published by the German Trade Service, Cologne in September 1990. The book costs DM29.80. Information on specific issues can be obtained from: BINE, Mechenstr. 57, 5300 Bonn 1, Tel: 0228/232086 (Ms. Hinz).

Solar installaton funding (without development, pilot and demonstration projects) Updated in June 1990

Land*	Solar heat	Solar power	Program/Requirements/Specific issues (by major items)	Application office/Approval authorities
Berlin	65%	75%	Land modernization program, 1-MW program (photovoltaic equipment of max. 1kW)	Senate Administration for Building and Housing, Wuerttenbergische Str. 6, Berlin 31, Tel: 030.867-4849
	55-65%	75%	Modernization and repairs guidelines (also for tenants)	Building society, Bundesallee 210, Berlin 15, Tel: 030/2103-327
Bremen	25-35%		Energy-saving improvements to buildings	Office for the Funding of Domestic and Urban Buildings, Breitenweg 24, 2800 Bremen 1, Tel: 0421/361-6022
Hamburg	DM5,000	DM4,500	Water heating for single family houses. Increased funding for multi-family houses. DM4,500 per seat for solar automobiles (single- or two-seater).	Office of the Environment, Division of Energy Policy and Water Supply, Alter Steinweg, 200 Hamburg 11, Tel: 34913-3237, -3450, -2494
Hessen	up to 30%			Hessen's Department of Economy and Technology, Kaiser-Friedrich-Ring 75, 6200 Wiesbaden, Tel: 0611/8172447

Solar installaton funding (without development, pilot and demonstration projects) Updated in June 1990 (Continued)

Land*	Solar heat	Solar power	Program/Requirements/Specific issues (by major items)	Application office/Approval authorities
Niedersachsen	up to 30%		Water heating and heating of public outdoor swimming pools	Niedersachsen's Department of Economy, Technology and Traffic, Friedrichswall 1, 3000 Hannover 1, Tel: 0511/120-6504
Nordrhein-Westfalen	25%	25%	max. DM5,00/kW output	Regional Mining Office, Goebenstr. 25, 4600 Dromund 1, Tel: 0231/5410-1
Saarland	up to 50%	up to 50%		Department of Economy, Div. G3, Hardenbergstr. 8, 6600 Saarbrucken, Tel: 0681/501-4247
Schleswig-Holstein		up to 30%	Excluding single family houses	Department of Social Affairs, Health and Energy, Div. 93, Kronshagener Weg 130a, 2300 Kiel 1, Tel: 0431/1695-341

Source: Deutscher Fachverband Solarenergie e.V. (DFS)

FACTORY AUTOMATION, ROBOTICS

Development, Startup of New German CIM System Described

91WS0058Aa Coburg MASCHINE & WERKZEUG in German No 20, Sep 90 pp 16-23

[Unattributed article: "Organized Throughout"; first two paragraphs are MASCHINE & WERKZEUG introduction]

[Text] Twenty-six machine tools are currently served by one system for CNC [computerized numerical control] program generation and program management.

The inventory now includes 25 turning, milling, and drilling machines and machining centers programmed via an NC organization system; in addition, the system ensures "problem-free DNC [direct numerical control] operation around the clock"—with production islands with 26 machines at three different production centers. The System 200 from Index, which can be integrated as CIM [computer-integrated manufacturing] components into a computer controlled industrial plant, is an infinitely expandable modular system "which can be optimally adapted to individual situations, to client demands." The modular design, the capability of virtually integrating all current and technically developable functions as new functions was a fundamental point which made the programming pros at Carl Hurth Maschinen- und Zahnradfabrik of Munich decide as early as 1982 in favor of the then basic model. Today, managers Reinhard Frisch and Reinhold Eisenreich are "convinced they are using a system which has to be considered one of the market leaders." And, as Index systems manager Dr.-Eng. Wolfgang Walter stresses, its continued enhancement and software support are guaranteed.

We were in Munich during inventory.

The system for computerized NC program generation and management runs under the VMS operating system on a DEC VAX cluster. The major areas of application at Carl Hurth are NC program generation for 25 machines (turning, milling, and drilling machines and machining centers), NC program management for a current total of 16,500 source programs and 18,800 paper tape records, support of graphics and dialog, DNC operation for 26 machines, including production islands around the clock at 3 different production centers. The system is also used for the technical master data management for machine tool, chucking equipment, materials, Schnittwert- and feed data all the way to the CAD/NC [computer aided design/numerical control] coupling to the ICEM-DDN CAD system from Control Data as well as machining time calculation for preliminary calculation.

Reinhard Frisch, "NC programming leader" from 1980 through 1987 and PPS project leader since then, who was responsible for the decision in favor of the Index system and its introduction, recalls: "Before its introduction we had a virtually untenable situation; in fact, in two plants we had three programming groups and five NC presetting groups—not to mention the fact that all the programming groups worked with different systems. Therefore, we simultaneously implemented an organizational system for turning and milling, i.e., introduced two systems, H 200 and H 400, at the same time. At the end of 1982 we began with the installation of two machines in the DNC operation and after that gradually transferred all the machines mentioned into the DNC system." The Hurth company has three areas of business: the area of machines and systems for complete gear production, the second area including complete drives and gears, and, finally, the third area which produces machine tools for its in-house machines, e.g, rotary shave cutters, profile cutters, burring reamers. The Munich company, a firm rooted in tradition, was founded in 1896, currently has approximately 1,400 employees, and is active worldwide through sales branches. The entire

program already points to the character of its production: As a rule, it involves single parts or relatively short runs, and, consequently, it was naturally essential to completely automate the program, with computer assistance, in order to retain the necessary flexibility at all times throughout the entire production cycle.

For this reason also, according to Frisch, they insisted on buying a standard system and constantly expanding it with updated versions. They thus consider themselves as a completely "normal" licensee, which has adopted all updated versions and modules since the use of the first system variation. Reinhold Eisenreich, NC program leader since 1987, previously Frisch's assistant, explained an additional aspect of why the entire system is optimally tailored to the parts spectrum: "We have to be capable of machining the smallest part of workpieces and gears of approximately 20 mm diameter up to 2 m. We thus produce little in series; our contract production consists primarily of single parts or short runs. This also suggests a great variety of types of our numerically controlled machine tools, and here I would like to expressly include the gear cutting machines."

With Additional Expansion Steps

For Dr. Walter it is clear that "in view of the increasing trend toward linking entire areas of production through computer technology, complete concepts of organization, programming, and control are becoming increasingly important for the user." The System 200 is subdivided into the following major groups: Programming module, control and management module, technology files, post processors, DNC system, machining time calculation module, CAD/NC coupling module. Among the most important programming functions are original programming, revision, copying, and deletion of programs, statements, words, or individual characters; geometric description in terms of points, point patterns, straight lines, arcs, and contours; geometric manipulation through enlargement, reduction, shifting, rotating, mirror imaging, automatic chamfering and rounding; technical commands with automatic determination of feed, cutting speed, and automatic work cycles for drilling, grinding, *Ausspindeln, etc., workpiece and workpiece-oriented programming of multiaxis processes on CNC lathes.

With the control and management module, it is possible, for example, to coordinate cycles such as creation of subprograms and starting of post processors or storing parts programs and NC programs in central data banks, searching, reading, deleting. Likewise, peripheral devices such as monitors, printers, paper tape readers, or NC machine tools can be controlled. Links to host computers or machine controllers are also organized via this module. In addition to the geometrical data, technical data are necessary for programming. These are present in the form of files. Thus, the machine tool file contains, among other things, the ID number of the machine tool, its name, the cutting material, the tooling method, adjustment standards, and machine tool characteristics. There are similar files for materials, cutting materials, and feeds.

A suitable post processor is important for the adaptation of the machine-neutral CLDATA-interface [cutter location data] to the respective machine control, even for foreign devices. It also handles many other functions such as control-oriented preparation of NC data, run time calculations for each machine tool, or reverse motion for tool changes. With the generalized post processor, all common controllers can be adapted to each other. Index considers the "machining time calculation" module a useful tool for precalculation—with it the primary time and the secondary times can be calculated for two to four axis CNC lathes for a given sequence of processes without great outlays for input. Finally, it is possible to make a comprehensive connection between the CAD system and machine controllers via a system-neutral coupling element CADNC 200. In connection with the CAD functions, this coupling element has recently become useable even as a mini CAD system. DNC has already been available for about a decade and a half, whereas on-line machine tool presetting has only been added as an expansion module in the last few years.

Here, Reinhold Eisenreich adds something else for his area; he has been responsible for a good two years "for smooth operation of the system": "In lathing we have already had the technical files in use for five years, but we are only using the machine tool memory so that for the machine tool command the lathe programmer now just writes in the ID number and receives all the prerecorded machine tool data. This means that with us this is still running without Schnittwertverrechnung and similar data, but we are in intensive discussions with Index on this matter, in order to implement this expansion bit by bit. Mind you, this applies to lathing; for milling we are comparatively farther along. With our large number of machine tools, chucking equipment, cutting materials, materials, *Schnittwerten, etc., the company-specific design of these files is a big job which is currently being implemented."

The most recent enhancements involve the shop dialog "which has been made even more user-friendly." This was achieved by improving the user interface and, as Dr. Walter stresses, also for the area of multiaxis programming. The same user interface is being used as with the programming of the CNC universal lathe. Additional, efficient language elements now facilitate the programming of complex workpieces which must be produced on multislide or multispindle lathes. The same programming system is used. There are still differences in the programming of multislide lathes compared to universal machines where it is a matter of simple flexible synchronization of the multislide lathes.

The four-axis optimization is being currently being expanded to multiaxis optimization, specifically with a view to the CNC multislide automatic lathe GB. If a tool support is in motion or in use, an appropriate bar is

plotted on a time axis. This plot is separate for each tool support so that time overlapping is visually obvious on one side of the screen. Finally, the volume-oriented collision check in the working space of the CNC universal lathe is being readied for production. With this it is possible to check, using computer-internal models for the machine tools, tools, and workpieces, whether collisions can occur. If appropriate, a message is displayed on the screen indicating which program statement can result in a collision. Then, an appropriate graphic is started. However, instead of this graphic the volume-oriented computer-internal collision check with the results of the check is in the foreground.

The integrated H200/H400 solution permits common programming. Formerly, the H400 language which was used for the non-lathe machines was somewhat different from that of the H200 processor for lathes. Now both are the same with identical user interface, identical dialog, identical language elements, and generalized post processor.

Once again, Dr. Walter refers to the development history: "For us, it was naturally clear from the beginning that we had to offer a system which can continuously be expanded through improvements and new modules. We began with the H100 as the programming system for our own lathes and then developed it for foreign devices, and in the mid-1970's it was enhanced for milling machines, centers, etc., i.e., for non-lathe machines. Especially since the beginning of the 1980's, at the very time when our company was moving ahead very strongly with the development of NC machines since increasingly higher demands were being placed on NC programming, for example, through our machines with C axes, the four-axis design, and complete processing on the lathe. Multispindle machines were developed with 32 NC axes or multislide lathes with 8 NC axes. And it was possible for us to completely satisfy the associated demands on NC programming through enhancements and through new modules. Finally, in the CAD area, which has played an increasingly significant role since the mid-1980's, we enhanced our software for the universal connection of H200/H400 to various CAD systems for effective CAD data acceptance. We can do that with relatively few problems since we are capable of acceptance and continued processing of data from different CAD systems. Consequently, we have a complete package which covers everything from the two-axis lathe all the way to the 32 NC axis and, as mentioned, can also accept CAD data to support DNC operation, etc."

And here reference was made to a factor which is also of special significance for the gear specialists at Hurth, namely, "that at the moment there is no supplier of NC programming systems in the German market which also actually uses everything it has developed," according to Dr. Walter. And, furthermore, "practical demands flow directly into system development, and the problems we encounter during testing of a new version can and must absolutely be solved in house. This also means that we virtually always bring a mature product to the market." Here again, they are realistic enough not to deny the common system-related "sensitivity" of software. Software users and developers are, of course, aware of it. It is not without reason that the first (slightly ironic) law of computer science is "Bug-free software is obsolete."

If we follow the development of the entire system, it is an obvious necessity for Index to design its contact with the user so closely that all problems which could possibly occur can be taken into consideration in the individual modules. Both Frisch and Eisenreich recall the in-house development. There were all kinds of suggestions of how to solve company-specific problems. "Thus it was necessary, for instance, in the case of foreign devices to introduce machine-specific features far beyond what was customary into the post processors." Eisenreich thinks, for example, of the vertical lathe with the capabilities of positioning the intertie rails in different positions. "Those were macros which Index bundled into the post processors for us."

Today, Hurth can certainly be considered one of the largest H200/H400 users in southern Germany. It speaks well for the experts from Esslingen, although it is natural for Hurth even in the future to adopt the modules which are in preparation. This specifically includes, for instance, tool management modules or simulation programs. Although according to Eisenreich and Frisch, there are still a few points which could be further optimized, such as better support for any update services, for program conditions, e.g., locked in operation, test required upon reinstallation, etc., for problems which affect overall machine tool management, Dr Walter can already point to developments in which all these items are taken into account. "On the subject of machine tool management it must be said that we already actually have a solution and are already using it in house. All in all, however, there is still some developmental work to be done before we release it for sale in 1991. In this area we are working with a partner. Also, with regard to the subject of DNC and IDC [industrial data capture], what is still lacking is the machine data capture and industrial data capture for foreign devices, which have been controlled thus far via our distribution devices. Here again, we will approach this task with a partner."

FRG: Trends in Factory Automation Viewed

91WS0002C Duesseldorf VDI NACHRICHTEN in German 7 Sep 90 p 32

[Text] Aachen 7 Sep 90—Computer communications will play a central role in the factory of the future. Therefore, hundreds of experts have been discussing for years now how to make open-ended and supplier-independent communication available. Success stories about MAP [Manufacturing Automation Protocol] and TOP [Technical Office Protocol] having found widespread acceptance are still elusive. But the applications business has not remained idle in the meantime, as was

reported by the CIM-Center NRW in Aachen. Following is a report by the Center's executive director, Hubert Schmidt, PhD.

For years, there have been intense efforts to develop networks. And this has not been the exclusive arena of activity of computer firms attempting to network their often very different systems. Especially the initiatives taken by large application firms in their endeavors to push the development of standards are met with great interest. Years ago, General Motors and Boeing, for instance, would not wait any longer and, in formulating MAP and TOP, set forth their own requirements for computer communications standards.

For the planning and establishment of CAD/CAM [computer-aided design and manufacturing] linkages, CIM, data bank allocation or similar items, networking is an important prerequisite.

To prevent uncontrolled proliferation, several standardization efforts are now underway. The standards; cornerstone is the Seven Layer Model of the Open-Ended Data Communication (OSI) set by the International Standards Organization (ISO). The Institute of Electrical Electronic Engineering (IEEE) which determines routine applications in its Standard 802, is responsible for the standardization of communications protocols.

Depending on their application, the characteristics of, and the demands placed on, the individual networks differ widely. In general, the network is expected to perform a high transmission rate of a relatively high number of data in as short a time as feasible. Furthermore, networks are supposed to be immune to listening-in, should cover large distances, are expected to undergo easy add-on expansions, and are supposed to serve a multitude of users. Also, acquisition, installation and operation costs should be low.

Of course, some of these demands made on the networks are in conflict with each other. For instance, a network with finite capacity is not capable of making available to an infinite number of users a large amount of data without resultant loss of time. Under such circumstances, consideration must be given in each instance which requirements have priority for what types of applications. For example, with respect to office communications different factors are important than with respect to the production floor, possibly resulting in more than one network being installed at one company.

Such networks are then linked within that company via company-wide linkages, so-called backbones. In joining these networks together it is preferable that the networks are linked such so as to make the entire network transparent to the useer, i.e., that he need not pay attention to the processes required to run the communication operations.

In the future, the "user networks" will be further developed as a result of even more efficient and sophisticated networking possibilities and advancements in standardization. With respect to LANs [local area networks], Ethernet and Token Ring have already taken the lead and they are expected to retain this lead in the future. The number of installations is increasing progressively and it is expected that by 1992, 30 percent of all corporate PCs in Europe will have been user.

Optic fiber networks will serve as the networks' backbone and will link individual department networks with one another or will find application in bridging large distances in major industrial complexes. With the aid of fiber optics technology, an FDDI [fiber-distributed data interface] standard, data transmissions can occur with a speed of up to 100 Mbit/sec.

The standardization efforts for FDDI are not concluded as of yet. Even though there have been offers for some time now to do purchases from individual manufacturers using this designation, they are not compatible with the products of others merchants. Thus, the possibility to communicate with devices made by different manufacturers, FDDI's single largest benefit, has not yet been taken advantage of. One fact pointing to FDDI becoming the standard in the foreseeable future is the involvement of currently more than 80 companies in the FDDI committee. FDDI is compatible with Ethernet and Token Ring/Bus.

During the past few years, reports have surfaced about sensational breakthroughs, especially in this area (MAP, TOP, FDDI, etc.). However, attempts to utilize these innovations for dealing with present tasks continue to fail as a result of attendant problems not having been solved satisfactorily as of yet and due to the currently exceedingly high costs of modern technologies. This, in turn, has users going back to the old conventional systems.

LASERS, SENSORS, OPTICS

Germany: New Laser Excitation Technique Developed

91P60080P Frankfurt/Main FRANKFURTER ZEITUNG?BLICK DURCH DIE WIRTSCHAFT in German 27 Dec 90 p 6

[Excerpt] In close cooperation with Professor Uhlenbbusch of the University of Duesseldorf, the Frankfurt-based firm Messer-Griesheim GmbH has developed a laser excitation technique that can be applied to high-power carbon dioxide lasers. The heart of the new technique is a microwave source or magnetron, such as those that can be found in conventional microwave ovens. In this application, magnetrons with power ratings from 1350 W to 2500 W can be used. For use in lasers, the magnetrons require only a network power source consisting of inexpensive standard components. This power source makes possible high power stability in carbon dioxide lasers, enables pulsed mode operation up to 10 kHz and even operation in the super-pulsed mode.

Coupling several magnetrons boosts laser output power. A laser module with two magnetrons, each rated at 2500 W, yields a kilowatt of laser output power. Higher multi-kilowatt laser output power ratings are possible by connecting several such modules in series. Two immediate consequences of the new excitation technique are the possibility of manufacturing carbon dioxide lasers at a lower cost and an expedient for regulating the power of even carbon dioxide lasers with transverse flow.

Germany: Dornier Builds, Inaugurates RCS Measurement Facility

91P60099P Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Nov 90 p 436

[Exceprts] After extensive research, Germany's Dornier GmbH has finally built and inaugurated a new radar cross-section (RCS) measurement facility incorporating state-of-the-art HF technology and destined for dealing with radar technologies of the future.

The measurement chamber is fully lined with cone-shaped microwave absorbers and can be used for examining the radiant behavior of new antennas or the radar backscatter cross-sections of bodies that scatter radiation, such as aircraft and satellites.

In the measurement chamber, the field generated by an energizing antenna system (feed system) is concentrated by two reflectors installed in the chamber in such a way that a planar wave with nearly homogeneous amplitude and phase distribution is generated in the testing zone (quiet zone). With the aid of the two reflectors, the signal reflected from the test specimen is reintroduced in concentrated form back into the feed system. A swiveling mount in the middle of the measurement chamber serves to orient the test specimen at various aspect angles, permitting it to be moved into the chamber's quiet zone where its directional backscatter or radiant behavior can be studied. While measurements are being carried out in the chamber, the microwave absorbers suppress interference, arising from multiple reflections, which could otherwise markedly influence the exact measurement results.

The processing of the required measurement values, as well as control of the measurement process, is handled by a computer system. Linked to this computer system are various peripheral devices for the storage of measurement data and the presentation of measurement results. The primary extension of the HF measurement system covers the frequency range from 2 to 18 GHz, a range that can be expanded to 100 GHz through the use of appropriate auxiliary devices.

The new equipment makes it possible to examine antenna radiation patterns, study radome characteristics, and investigate backscatter cross-sections as well as two-dimensional radar images. Two distinct advantages of the new compact measurement system are that, compared to operations in stretches of empty space, measurements can now be carried out free of interfering external reflections and the measurement results are reproducible under identical conditions.

UK: Oxford Laser Unveils Laser Stroboscope

91WS0014B Paris L'USINE NOUVELLE in French 6 Sep 90 p 78

[Article by Christian Cathala: "Capturing Ultra-High-Speed Phenomena"; first paragraph is L'USINE NOUVELLE introduction]

[Text] **A British company is about to introduce a visualization device making it possible to study phenomena which until now remained fuzzy.**

How can you follow a bullet traveling at over 5,700 km/h? Or analyze the path of a 50-micron droplet coming out of an aerosol spray at over 70 km/h? At the end of the month, the engineers of the British company Oxford Laser will introduce a device making it possible to visualize ultra-high-speed phenomena like these. The major novelty of the device, which otherwise uses a traditional design, lies in the light source used: rather than continuous light sources or flash-type systems, the British firm is using the properties of copper-vapor laser. In an extremely short time (about 30 nanoseconds, i.e., 30 billionths of a second), this laser source emits a beam the way a stroboscope does (hence its name of Laserstrobe). The light is sent from the laser through an optic fiber which illuminates the object. The scene, filmed at 20,000 frames per second by an ultra-high-speed camera of the Kodak or Handland type synchronized with the laser, is thus illuminated for a time 1,000 times shorter. "Many physical phenomena were visualized with such fuzziness that we could not see anything. Thanks to this laser, scenes can literally be frozen," we were assured by Francois-Xavier Brown, engineer a Sopra which will market the Laserstrobe system in France (it should cost around 500,000 French francs).

Across the Channel, some manufacturers have implemented the technology without waiting for the Laserstrobe to become available. For instance, at the Shell research center, engineers analyze gasoline vapor turbulence in various applications; the Rolls-Royce engineering and design department is studying air behavior in jet engine turbines; and the University of Manchester is using the process to develop textile machinery to spin cotton at very high speeds.

The Oxford Laser system seems to have already crossed the Channel: Daimler-Benz is already using it to improve fuel combustion in its Mercedes cylinders.

Considering the prevailing uncertainties as to the price of a barrel of crude oil, fuel efficiency optimization problems are more than ever the order of the day. Other men's sorrow might turn out to be Oxford Laser's joy....

MICROELECTRONICS

Germany's Robotron Develops Multilayer Wiring Receptacle

91WS0040A East Berlin FEINGERAETETECHNIK in German Sep 90 pp 388-389

[Article by Dr.-Ing. H. Kleineberg, and Dipl.-Ing. R. Weckesser: "Mult-Layer Wiring Systems in Thin-Layer Technology"]

[Text] The objective was to develop a wiring receptacle for using uncapped wire-bonded Si gate array chips based on available technologies.[1] In achieving this objective, a qualitative increase in the overall density was to be obtained by way of the wiring hierarchy of circuit—wiring receptacle—plug-in module—computer assembly. The chosen solution, 3-level thin-film wiring receptacles with a wiring grid of 63 µm (Figures 1, 2), proved superior to competing solutions (e.g., multilayer thick-film technology, the use of SMD [surface mounted defice] components on micro-miniature circuit boards, gate array SK) in appropriate preliminary investigations.[2] For this solution, the following advantages are salient:

- a very high wiring and packaging density
- good heat dissipation conditions
- available facilities and materials
- high design flexibility
- small economical quantities per type
- additional components (resistors, capacitors) can be used
- short signal delay times
- experience in the use of the basic technologies in our own factory and at partners in the national economy.

One or more of these advantages are found with respect to each of the alternative solutions.

1. Architecture and Technology

The substrate is an unglazed thick-film Al_2O_3 ceramic. To reduce the need to modify available facilities, an overall size of 2" x 2" with an initial size of 60 mm x 60 mm was selected. The conducting layer consists of sputtered aluminum having a thickness between 2.8 and 5 µm. In this way, the resistance per square was kept well below the maximum permissible resistance per square of 15 Ω. The bonding ability of the Al conducting layer depends essentially on its manufacturing conditions, primarily on the residual gas pressure during sputtering. A strong correlation exists between bonding ability, average curling pull-off force, conductivity and the temperature coefficient of the Al resistance (Figure 3).

To improve the adhesion of the photoresist and to ensure the transition resistances between the conducting layers (via resistances), intermediate layers made of CrNi were sputtered in a vacuum sequence to a thickness of 50 nm. In addition, a FeNi layer that is 0.4 µm thick and which can be soldered was sputtered on the topmost conducting

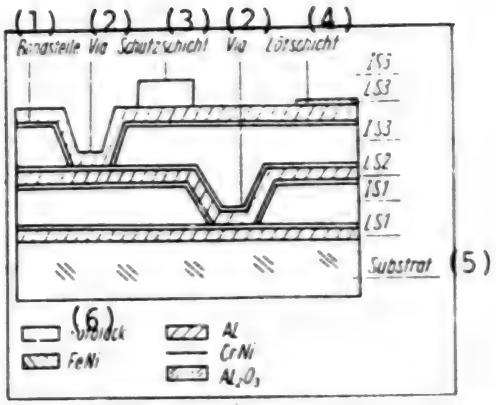


Figure 2. Cross-sectional, schematic view of the wiring receptacle

Key: (1) Bonding junction (2) Via (3) Protective layer (4) Solder layer (5) Substrate (6) Photoresist

layer. Fully cured positive photoresist is used as the insulating layer between conducting levels and as an additional layer of corrosion protection over the topmost conducting layer. This also ensures the ability to provide the required fine structure. The third conducting level of the finished wiring receptacle can be attached using adhesive, bonded by ultrasonics and soldered so that the required components and the connecting hardware (combs) may be attached.

The connections are mounted to all four sides of the wiring receptacle on a grid of 0.635 mm. The two lower conducting levels contain the actual wiring structure in the form of orthogonally positioned lines with nested power supply lines. As a rule, the power supply lines are 1 mm wide and the signal lines are 35 µm wide. The topmost conducting level contains only the bonding junctions and reserve wiring.

2. Experience and Problems

During development, a series of problems arose for which concrete technological solutions had to be found. The most important of these problems are described here, each at their point of appearance or in their environment.

2.1. Type of Substrate

The use of thin-film ceramic, glazed thick-film ceramic, and unglazed thick-film ceramic was investigated. The thin-film ceramic was eliminated for reasons of cost. A less expensive solution using glazed thick-film ceramic, while being optimal for both the ability to provide structure and freedom from defects, could also not be selected. This was due to the fact that the glaze could not withstand the high thermal loads during manufacturer with conjunction the high inner stresses of the total layered package of up to 20 µm in thickness. Primarily unconnected trace ends flaked off massively, damaging the glazed surface. Unglazed thick-film ceramic was

determined to be the optimum solution. With this ceramic, the largest uneven feature, primarily pits up to 10 µm, must be leveled using a layer of photoresist. The layer of photoresist is exposed without a mask to such an extent that during development only the larger and deeper pores remain fill with photoresist. As a final step, the photoresist is cured at 200°C. This results in a rough surface with extremely good adhesion of the thin-film system. It also provides adequate evenness to be able to produce structures of up to 10 µm lateral dimension with sufficient accuracy. Following the last structuring step, the raw substrates are cut to the nominal size of 2" x 2".

2.2. Insulating Layer

Photosensitive material was used throughout for the wet-chemical structuring of the conducting levels. Positive photocopier fluid SCR 17.1 of the La Chema company of Brno, Czechoslovakia, was also used for the insulating levels. This fluid is applied with a layer thickness of 2 µm using the rotational method. It is then normally exposed and developed (exposing the vias and additional technological areas). Following this, the remaining resist mask (insulating layers) is cured for roughly 60 minutes at about 200°C. Under these conditions, the resist cures completely and forms an insoluble layer of sufficient hardness. This process is executed twice for each insulating level. This is because only a double layer of resist having an average thickness of 4 µm ensures complete covering of the texture of the lower level. This double layer provides electrical insulation for this texture which can be up to 10 µm deep. In order to ensure adequate adhesion of the following conductive level and to improve the quality of the vias, it was necessary to provide a preliminary treatment in a vacuum cycle before the next sputtering process. As experiments using plasma etching did not yield the desire success, an ion beam source was used. The required values could be achieved in this way. However, the ion beam source treatment must be optimized precisely as it could easily result in an irreversible change in the resist layer. This expressed itself sometimes in a lateral conductivity of the photoresist surface, sometimes in a blistered "burning" of the resist layer.

2.4. Vias

After an initial failure, it was found that, with the use of a CrNi adhesion and contact layer with the ion beam source preliminary treatment, the vias are relatively uncritical. This assumes a structurally precise exposure. The via resistances achieved lie in the range of a few milliohms (Figure 4). They correlate with the via size. However, the resistance does not grow in proportion to a reduced via area but slower (roughly corresponding to the circumference to the via). Because this, vias ranging from 15 µm x 15 µm to 50 µm x 40 µm may be used successfully.

2.5. Connection Elements

The connection elements proved to be a particular problem. That is, the unconnected trace ends in the area

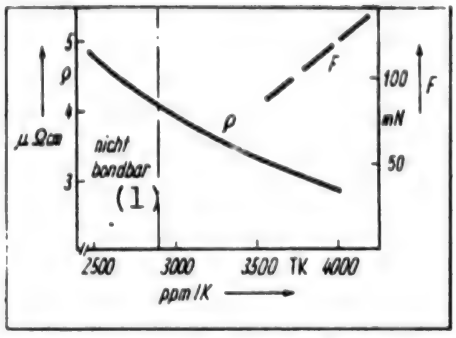


Figure 3. Average curling removal force F of the bond junctions and specific resistance of the Al conductive layer as a function of the temperature coefficient of the resistance of the Al conducting layer.

Key: (1) Cannot be bonded

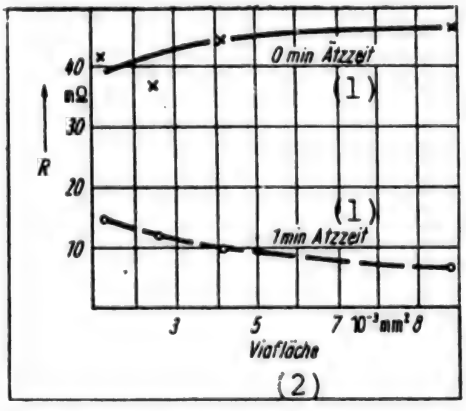


Figure 4. Via resistance shown as a function of the via area during the CrNi/CrNi transition.

Key: (1) Etching time (2) Via area

of the edge intended for solder assembly for the connecting combs presented difficulties. On the one hand, these elements are about 10 µm thick and are exposed to the attack of etchant a number of times. On the other hand, they must be covered with a resist mass of up to 20 µm in thickness in the "shadow" of the active wiring receptacle area. Because of this, there were sometimes systematic breaks in the transition area, sometimes short circuits due to remaining "photoresist threads" in the valley. Only through appropriate template changes was it possible to eliminate both problems. Due to this, the originally planned optional access to any layer of the connection elements had to be dropped. The solution was to route all connections in the active wiring area through vias down to the first conducting level and from there in a uniform manner out to the connection elements.

2.6. Cleanliness and Freedom From Defects

In spite of the relatively coarse lateral dimensions (trace width: roughly 35 µm), clean-room conditions were

necessary (RR class: 100...1000). This resulted from the small layer thicknesses in conjunction with the rotational application of the photoresist. In particular, achieving complete electrical insulation of the conducting levels with respect to one another was shown as very defect-prone. Trace breaks in a single level occur rarely whereas lateral short circuits due to contaminated exposure templates and a lapse in technical discipline were relatively frequent.

2.7. Fiducial Points

A specific problem was the visibility of the fiducial points made of sputtered metal on unglazed thick-film ceramic. While the points could be clearly seen with the naked eye in spite of their smallness, the difference in reflection in the reflected light microscope of the adjusting and exposing equipment was so small that positioning was impossible. It became necessary either to produce a photoresist base or to convert the exposure facility to a halogen lamp combined with a polarization mechanism.

3. Summary

It is possible using existing facilities and material, to develop and manufacture a multilayer thin-film wiring receptacle with a very high wiring density. This was developed at Robotron-Elektronik Dresden for use in high-performance, compact computers. As a standard, six chips with edge lengths of 8.5 mm having 124 bonding joints per chip including the back-up capacitors are wired. The finished module with a metal cap, connecting combs and heat sinks if necessary can be viewed as an SMD component. Because the substrate has high thermal conductivity, high dissipation lines in the module can be converted in conjunction with an attached heat sink.[3,4]

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Siemens Develops Power Metal Oxide Semiconductors

91WS0014A Paris ELECTRONIQUE ACTUALITES in French 14 Sep 90 p 35

[Article by J. Marouani: "Siemens Innovates in Power IC's [Integrated Circuits]"]

[Text] Villach—Under the name SIPMOS (for Siemens Power Metal Oxide Semiconductors), the German firm has developed several generations of power ICs, trying to get ahead of its competitors through technological innovation. Today, it does it again with "intelligent" components which include, on the same chip, a field-effect transistor (FET) and CMOS [complementary metal oxide semiconductor] logic. These components are already produced in quantities at Villach, in southern Austria. This is the factory where Siemens gathers its forces: most SIPMOS products are manufactured on a 5-inch wafer production line the capacity of which currently exceeds 200,000 wafers per year. The company's ambition is to consolidate its position on the MOS [metal oxide semiconductor] power IC market, which remains buoyant year after year. It is expected to grow 20 percent per year from 1990 and 1995, from $560 million to $1.7 billion. In 5 years from now, Europe will be the leading world market, ahead of Japan and the United States.

According to Dr. Horst Fischer, board member of the Siemens semiconductor group, three factors condition the success of electronic equipment: innovative ICs, advanced architecture, and reliable software. The new generation of SIPMOS products is the German company's contribution to users. It targets the telecommunications, data-processing, and automobile markets, the industrial sector, as well as consumer electronics. The "intelligent" SIPMOS specifically designed for automotive electronics and industrial process control can actuate amplifiers ("actuators") in the 1-40-A range. Up to 14 A, it is possible to use a single power IC with a FET and CMOS logic on the same chip. Above 14 A, two chips are usually required, but Siemens already manufactures so-called "chip-on-chip" components in Villach; these are suitable up to 20 A (BTS-432, BTS-532). Research and development concerning "intelligent" SIPMOS products continue. A cell library will be introduced in the near future. It will enable users to develop specific applications based on "intelligent" SIPMOS circuits. These new proprietary products may then be manufactured at Villach.

IGBT 1200-V Modules

Another innovation concerns the IGBT (insulated-gate bipolar transistor) modules. After the 1000-V 75-A 180-mm^2 chips now being produced, the first models of a 1200-V chip family are taking shape: samples are already available. The new line will include discrete switches, half-bridges and bridges.

Some time last year, the production of wafers dedicated to SIPMOS components was progressively shifted from Munich to Villach, and output was increased by over 20 percent. Efficiency was also improved, thanks in particular to the experience acquired with DRAMs [dynamic random access memories]. Actually 256K dynamic memories will still be produced at the Austrian site for a year or so. Of all the wafers already introduced, 18 percent are used in SIPMOS products (compared with 5 percent last year), 75 percent form the bases of logic products (compared with 47 percent in 1988-1989), and 7 percent are used for 256K DRAMs (compared with 48 percent one year ago). This new breakdown is that of the 5-inch line production, in Villach. At full capacity, SIPMOS production could reach 200,000 wafers per year. In addition, the Japanese company Fuji Electric produces SIPMOS transistors for its own market, under a Siemens license; it also works as a silicon foundry for Siemens.

Growth Prospects

The technological assets of the German company in the field of power MOS circuits should enable it to consolidate its position in individual product groups. In power transistors, the company expects to retain the third place worldwide (a 10-percent market share). In small-signal transistors, it ranks second, not far from Siliconix, with a 12-percent market share. In "intelligent" MOSFET [metal-oxide semiconductor field-effect transistors], it is the leader, with 25 percent of the world market. Finally, Siemens holds 16 percent of the world IGBT module market, ranking third after Toshiba and Mitsubishi. Siemens intends to win new market shares for each of these three product families.

NUCLEAR ENGINEERING

EC Adopts Thermonuclear Fusion Program

91AN0062 Luxembourg OFFICIAL JOURNAL OF THE EUROPEAN COMMUNITIES in English No C261, 16 Oct 90 pp 8-15

[Article: "Proposal for a Council Decision Adopting a Specific and Technological Development Programme in the Field of Controlled Thermonuclear Fusion (1990 to 1994)"—COM(90) 441 final]

[Text] The Council of the European Communities,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the proposal from the Commission, which has consulted the Scientific and Technical Committee,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the Economic and Social Committee,

Whereas, by Decision 90/221/Euratom, EEC, the Council adopted a third framework programme of Community activities in the field of research and technological development (1990 to 1994), specifying *inter alia* the activities to be pursued in the area of controlled nuclear fusion; whereas this Decision should be taken in the light of the grounds set out in the preamble to that Decision;

Whereas the activities falling under the EAEC [European Atomic Energy Community] Treaty, Article 2 of the Decision adopting the third framework programme foresees its implementation through programmes adopted in accordance with Article 7 of the said Treaty;

Whereas the Commission has arranged for the evaluation and appraisal foreseen in Article 3 of Decision 88/448/Euratom, and is submitting the present proposal on the basis of this evaluation and appraisal;

Whereas the Joint Research Centre [JRC] shall contribute through its own programme to the implementation of the aforesaid activities;

Whereas an estimate should be made of the amount of Community financial resources needed to carry out this specific programme; whereas the definitive amounts will be fixed by the budgetary authority in line with the financial perspectives covering the period 1988 to 1992 included in the interinstitutional Agreement of 29 June 1988 and with any future financial perspectives covering the period 1993 to 1994;

Whereas, pursuant to Article 4 and Annex I of Decision 90/221/Euratom, EEC, the amount deemed necessary for the whole framework programme includes an amount of ECU 57 million for the centralized dissemination and exploitation of the results to be divided up in proportion to the amount envisaged for each activity; whereas, in view of the importance of this specific programme within the "energy" action, the estimate of the financial resources needed by this programme is to be reduced by ECU 4.17 million, which amount is to be allocated to the centralized activities;

Whereas this programme must be implemented by the Commission, as foreseen in Article 7 of the Treaty; whereas to help accomplish this, the Member States are bound, pursuant to Article 192 of the Treaty, to facilitate the achievement of its tasks where necessary;

Whereas the implementation of the Joint European Torus (JET) project has been entrusted to the "Joint European Torus (JET), Joint Undertaking," established by Decision 78/471/Euratom, as amended by Decision 88/447/Euratom, and as last amended by Decision 90/.../Euratom.

Whereas the programme embraces all work carried out in the Member States in the field of controlled thermonuclear fusion by magnetic confinement; whereas the execution of this programme must involve the selection

of research and development projects to enable them to benefit from Community participation; whereas a special procedure should also be devised so as to maintain a degree of flexibility enabling the Commission, in the face of the continuous evolution and gradual acceleration of technological progress, also to take into consideration spontaneous proposals consistent with the objectives of the programme;

Whereas the projects to be carried out under the programme must be selected with special attention to the principle of economic and social cohesion in the Community, the transnational nature of the projects, and the support to be given to small and medium-sized enterprises;

Whereas the Community's activities aimed at strengthening the scientific and technological basis of European industry and encouraging it to become more competitive include promoting cooperation on research and technological development with third countries and international organizations; whereas such cooperation may prove particularly beneficial to the development of this programme;

Whereas, pursuant to Article 101 of the Treaty, the Community has concluded Cooperation Agreements in the field of controlled thermonuclear fusion and plasma physics with the Kingdom of Sweden and with the Swiss Confederation; whereas the Community has entered into an Agreement of Participation in the international thermonuclear experimental reactor (ITER) conceptual design activities, together with Japan, the Union of Soviet Socialist Republics, and the United States of America and is negotiating an Agreement of Participation in the international thermonuclear experimental reactor engineering design activities together with the same countries; whereas the Community has entered into a Memorandum of Understanding with the Government of Canada on the involvement of Canada in the European contribution to the ITER conceptual design activities;

Whereas it is necessary, as Annex II to Decision 90/221/Euratom/EEC provides, to conduct in the Community a fusion programme whose long-term objective is the joint creation of safe, environmentally sound, prototype reactors,

Has adopted this decision:

Article 1

A specific research and technology development programme for the European Atomic Energy Community in the field of controlled thermonuclear fusion, as defined in Annex I, is thereby adopted for a period of five years as from 1 January 1990.

Article 2

1. The Community funds estimated as necessary for the execution of the programme under this Decision amount to ECU 458 million. This amount includes ECU 417 million for the execution of the activities approved by the present Decision, and ECU 41 million for the activities which the JRC will contribute to the programme and which will be subject of a separate decision of the Council.

2. From the above sum of ECU 417 million, an amount of ECU 4.17 million is drawn for the centralized action of dissemination and exploitation of results. The funds thus reduced to ECU 412.83 million include staff costs, which may amount to a maximum of 10 percent, and also expenditure in relation to a maximum of 191 temporary employees assigned to the JET Joint Undertaking within the meaning of Article 2(a) of the conditions of employment of other servants of the European Communities.

3. An indicative breakdown of expenditure is set out in Annex II.

4. Should the Council take a decision in implementation of Article 1 (4) of Decision 90/221/Euratom, EEC, this decision shall be adapted to take account of the above mentioned Decision.

5. The budgetary authority shall decide on the appropriations available for each financial year.

Article 3

Rules for the implementation of the programme are set out in Annex III.

Article 4

The rate of the Community financial contributions shall be laid down in accordance with Annex IV to Decision 90/221/Euratom, EEC.

Article 5

1. During 1992, the Commission shall review the programme and address a report on the results of the review to the Council and the European Parliament, together with proposals for any necessary changes.

2. At the end of the programme the Commission shall assess the results obtained. It shall address a report thereon to the Council and the European Parliament.

3. The reports shall be drawn up having regard to the objectives set out in Annex I to this Decision and in accordance with Article 2(4) of Decision 90/221/Euratom, EEC.

Article 6

For the implementation of the programme, the Commission shall be assisted by the consultative committee for the fusion programme set up by Council Decision of 16 December 1980.

Article 7

In implementing this programme, supplementary programmes and joint undertakings within the meaning of Articles 45 to 51 of the Treaty may also be decided on as the need arises.

Article 8

Where cooperation with third countries and international organizations aiming at achieving the objectives of this programme requires agreements or contracts under Article 101, second paragraph of the Treaty, the Commission shall be authorized to negotiate.

The conclusion of such agreements or contracts shall be made in accordance with the provisions described in this paragraph.

Article 9

This Decision is addressed to the Member States.

Annex I

Scientific and Technical Objectives and Content

This specific programme fully reflects the approach embodied in the third framework programme in terms of the scientific and technical goals and the underlying aims which it pursues.

Paragraph 5C of Annex II to the framework programme forms an integral part of the present specific programme.

The long-term objective of the Community fusion programme, embracing all activities undertaken in the Member States in the field of controlled thermonuclear fusion by magnetic confinement, is "the joint creation of safe, environmentally sound prototype reactors" (Decision 90/221/Euratom, EEC). A stepwise strategy towards the prototype commercial reactor is foreseen, including after JET, an experimental reactor (Next Step), and a demonstration reactor (DEMO).

The first priority objective of the specific programme (1990 to 1994) is to provide the scientific and technological base, and to prepare industry for the construction of a Next Step device. The major physics goal of the Next Step will be the achievement of self-sustained thermonuclear burn of deuterium-tritium plasma and its control during long pulse operation. The Next Step should demonstrate the safe operation of a device that integrates important technologies of a fusion reactor, and should test components and subsystems essential for a fusion reactor. The Next Step must provide the basic data for building a demonstration fusion reactor (DEMO) capable of producing electricity with a capacity comparable to that of future commercial plants, taking due account of environmental constraints.

Other objectives of the specific programme are:

— To proceed along the demonstration of the safety and environmental feasibility of fusion power in parallel with the demonstration of its scientific and technological feasibility;

— To enlarge the involvement of European industry, with the views of both injecting industrial expertise into the realization of the Next Step and ensuring that Europe will master all the technologies which will be required for the construction of future fusion reactors;

— To determine the reactor potential of toroidal magnetic configurations akin to the Tokamak, concentrating on stellarators and reversed field pinches;

— To maintain a watching brief on other approaches to controlled fusion;

— To strengthen the links between the Associations and the rest of the European scientific community, in particular with universities and similar institutions.

In order to fulfill the first priority of the specific programme, a large fraction of the 1990 to 1994 activities, including those performed on JET and within the Associations, will be in support of the Next Step. Balanced efforts and coherent planning will be ensured between the Next Step design activities, supporting research and development in physics and technology, and industrial involvement.

The following presents an analytical description of the content of the programme, based on and taking account of the above elements as well as the independent evaluation of the programme and of the appraisal of the environmental, safety-related, and economic potential of fusion, performed in 1990 according to Council Decision 88/448/Euratom.

Area 1: Next Step Design

Next Step conceptual design activities are being completed in the European frame, NET (Next European Torus), and also in the frame of a quadripartite international collaboration, ITER (international thermonuclear experimental reactor), between the Community, Japan, the USSR, and the USA. The engineering design of a Next Step device will be undertaken according to the following guidelines:

— The quadripartite approach of ITER will be preferred for technical and economic reasons and the Community's current position of preeminence in large tokamaks, acquired especially through JET, will be maintained by a full commitment to the project;

— Efforts will be made towards a convergence of the NET and ITER designs;

— The Community will make all efforts to host the ITER engineering design activities. Pending a further European site proposal for engineering design activities, the Community offers a site at the Euratom-Max Planck-Institut fuer Plasmaphysik Association at Garching;

— A possible broadening of the collaboration on the ITER device to embrace an articulated ITER programme will be investigated. In such a programme the main facilities in fusion reactor development would be shared among the partners with a view to ensure equal benefits to the partners;

— The Community fusion programme will the capability to proceed with NET if the ITER cooperation proves too difficult to continue. [sentence as published]

The engineering design of a Next Step will be started as soon as the frame in which it will be undertaken will be agreed. In the proposed case of ITER, the fall-back capability of designing a leaner version of NET, still able to study ignition and long burn in reactor relevant conditions, will be preserved.

Next Step-related physics R&D actions will be undertaken on JET and on the specialized devices in the Associations (see area 3 and 4).

Actions in fusion technology, specific to the Next Step, in particular in the fields of superconducting magnets, plasma-facing components, operational and environmental safety, fuel cycle, and remote handling, maintenance and decommissioning of the device, will be performed in the Associations, in the JRC, and in industry. These specific actions will be made consistent with the Community commitment to the ITER engineering design activities. The actions aiming at preserving the fall-back capability of the Community to construct a Next Step on its own and involving a substantial financial commitment will be considered in the frame of the next framework programme.

The construction of the Next Step may be proposed during the period of the next Community framework programme, together with the required adjustments in organization, management, and industrial policies. In preparation, a study will be carried out on the policies adopted for large scientific and technical projects such as space research and large accelerators.

Area 2: Long-Term Technical Developments

Environmental and safety criteria will be essential elements governing the evolution of the fusion programme. In particular, work on such issues as the development of low activation materials relevant for a reactor, the development of reactor blanket modules, and a reference design for a commercial fusion reactor will be undertaken in the Associations, in the JRC, and in industry.

Material testing requires a powerful source of high energy neutrons. In a first step, a collaboration on the adaptation and the use of an existing source outside Europe will be sought.

The development of DEMO-relevant tritium breeding blankets modules will be pursued, in view of subsequent testing in the Next Step. These modules should be relevant for an electricity producing reactor, in particular regarding operating temperature and tritium breeding ratio.

The reference design for a commercial reactor will be based on deuterium-tritium reactions. Consequences of using advanced fuels presenting additional advantages regarding safety and environment will be investigated. The work on reference design will take into account views on social acceptability of fusion and on the requirements of utilities in operating such a reactor. It will constitute the technical basis for further safety analysis.

Area 3: JET

The full exploitation of JET in its phases of deuterium plasmas, in the context of a prolongation of the Joint Undertaking to 1996, will be completed by establishing reliable methods of plasma purity control in conditions relevant for the Next Step Tokamak. Where appropriate, JET equipments and expertise will be used to perform specific developments in support of the Next Step. A substantial contribution to the JET programme will be provided by the Associations, both by supporting activities (see area 4) and by transfer of staff.

Furthermore, preparation will be undertaken for the final phase of JET with deuterium-tritium plasmas, foreseen to take place in 1995 and 1996. A rigorous scientific, technical, and safety assessment will be carried out as part of this preparation.

Area 4: Support Programme

Scientific Support to the Next Step and to JET

The activities of the specialized devices within the Associations will be focused on programmes of work in support for the Next Step and for JET as well as on exploration of concept improvements. In particular studies about confinement, magneto-hydrodynamic stability, plasma-wall interaction, fuelling and exhaust, heating, and current drive will be carried out on existing devices: Tore-Supra, Asdex-Upgrade, Textor, FTU, Compass, TCV, RTP and Isttok. A revised proposal concerning a compact tokamak, Ignitor, might be submitted for in-depth examination.

New plasma diagnostic methods will be developed and theoretical activities, in particular on plasma modelling, will be carried out to support these studies.

Some existing tokamak devices, such as Asdex and TCA, will be phased out having completed their experimental programmes.

Studies on Alternative Lines in Toroidal Magnetic Confinement

The newly built stellarator, Wendelstein VII-AS, will be fully exploited. Pending the outcome of an in-depth examination, the engineering design of a large advanced stellarator, Wendelstein VII-X would be undertaken. The possible construction of such a device would be considered in the frame of the 1993 to 1997 framework programme. Another stellarator, TJ-II, is being constructed for operation to start in 1995.

Following its completion in 1991, the large reversed field pinch, RFX, will investigate plasma confinement and plasma purity at high current. The construction of Extrap-T2 will be completed and its exploitation undertaken.

Several smaller devices, such as the stellarator Storm, the reversed field pinches HBTX and ETA-BETA II, and Extrap-T1 will be phased out having completed their experimental programmes.

Other Approaches to Controlled Fusion

Current work going on elsewhere on other approaches to controlled fusion will be followed closely. The present keep-in-touch activity with inertial confinement fusion will be continued, subject to a periodic reassessment of its reactor potential compared with that of magnetic confinement fusion.

Annex II

Indicative Breakdown of Expenditures

As a percentage for the 1990 to 1994 period:

Area 1: Next Step design	15 to 25
Area 2: Long term technical developments	5 to 10
Area 3: JET	45 to 55
Area 4: Support programme	20 to 30

The breakdown between different areas does not exclude the possibility that projects could cover several areas.

Annex III

Rules for Implementing the Programme and Activities for Dissemination and Exploitation of the Results

1. The Commission shall implement the programme on the basis of the scientific and technical content described in Annex I.

2. The rules for implementing the programme, referred to in Article 3, comprise research and technological development projects, the JET Joint Undertaking, accompanying measures, and concerted actions.

The direct research activities carried out by the JRC will be the subject of a separate Council Decision.

The projects shall be the subject of shared-cost research and technological development contracts in the frame of: Contracts of Association with Member States, organizations in the Member States, Sweden, and Switzerland; the JET Joint Undertaking, the NET Agreement (to be extended and/or modified in view of the possible Euratom participation in ITER); the Long-Term Development Agreement (to be established); and other contracts of limited duration.

The accompanying measures consist of applying the means to ensure proper technical execution, management, and evaluation of the programme, as well as adequate dissemination and accessibility of the results, and coordination, training and consciousness-raising, of the participants in the programme.

The concerted actions are those defined in the Financial Regulation.

3. The participants in the projects must be natural or legal persons established in the Community, Sweden, or Switzerland, such as universities, research organizations, and industrial firms, including small and medium-sized enterprises, or associations thereof, in particular European economic interest groupings (EEIGs).

Natural or legal persons, established in countries other than Sweden and Switzerland, which have concluded agreements with the Community foreseeing scientific and technical research, may, based on the criterion of mutual advantage, take part in the projects undertaken in the context of this programme. The Contracting Parties under such arrangements shall not benefit from Community funding. They shall contribute to the general administrative costs.

4. The choice of projects shall be carried out according to the following order of priority, the first method being the rule, the second the exception.

The projects shall be selected on the basis of the ordinary procedures defined in the Contracts of Association, the JET Statutes, the NET Agreement, the Long-Term Development Agreement (to be established), and any Community-wide agreements that may be concluded following the advice of the consultative committee referred to in Article 6. For projects that are awarded priority status by the consultative committee, all Associations shall have the right to take part in the experiments carried out on the equipment thus constructed.

The Commission may also accept proposals according to an exceptional procedure and under the conditions mentioned below, when they make a particularly promising and significant contribution as regards the originality of the theme proposed, the novelty of the scientific and technical approach, and the methodology of execution, also taking into account the particular nature of the proposers.

A favourable technical evaluation of such proposals shall not by itself be a sufficient justification for accepting a project; this exceptional procedure may only apply after verification that the nature of the project, as defined above, does not justify the use of one of the normal procedures.

The amount of the financial participation of the Community for all the projects retained by the exceptional procedures will be decided each year, in relation to the projects selected according to particularly strict criteria of excellence. In any case, this amount may not exceed 5 percent; it may be revised each year in the light of experience.

The Commission shall draw up a vade mecum setting out all the rules applicable to this exceptional procedure in order to guarantee full transparency.

5. The Commission may encourage the participants to form a European economic interest grouping (EEIG) or make other arrangements for carrying out projects, such as those on a large scale, permitting decentralized management adapted to the specific requirements of the project.

6. The knowledge acquired during the course of the projects shall be disseminated on the one hand within the specific programme and on the other hand by means of a centralized activity, pursuant to the Decision referred to in the third subparagraph of Article 4 in Decision 90/221/Euratom, EEC.

Germany Undertakes Major Fuel Element Disposal Experiment

91MI0046 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 19 Oct 90 p 9

[Text] Development work on the direct ultimate disposal of spent fuel rods has been in progress in the Federal Republic since 1979. This method of nuclear waste disposal is scheduled to be ready for application by 1994. While the nuclear power station operators develop reprocessing technology (packaging technology) and the permanent storage containers, the BMFT (Federal Ministry of Research and Technology) is funding work in connection with the ultimate disposal site, irrespective of its actual location, and is coordinating this work through the PAE project team established at the Karlsruhe Nuclear Research Center.

Demonstration tests with large containers play a central role in the current program. The direct ultimate fuel rod disposal concept on which the research is focusing involves packing the spent fuel rods in thick-walled, self-shielding containers that will be deposited in the galleries of permanent disposal mine in a salt formation. This calls for demonstration of the transport and safe handling of large, heavy permanent waste disposal containers and research into the behavior of salt as the ultimate disposal medium under the specific extreme conditions of gallery storage.

The demonstration test entitled "Thermal Simulation of Gallery Storage" was started up in the Asse salt mine in the rural district of Wolfenbuettel on 25 September 1990. This test reproduces the ratios in the permanent store to the simulated loaded permanent disposal containers for spent LWR [light-water reactor] fuel rods on a scale of 1.1. At a depth of 800 meters below the earth's surface, two galleries were driven into the salt hills, and three electrically-heated 65 tonne containers were deposited in each one. When all the necessary measuring instruments were in position, the galleries were filled with salt slack. The heat generated by the spent fuel rods was simulated by the electric heating in the containers, and the rock salt surrounding the containers was heated to temperatures up to 200°C.

The test field with the two galleries and the containers is equivalent of a segment of an ultimate spent fuel rod disposal site, so the effect of the stored simulated waste containers on the surrounding salt hills can be examined in full scale with the thermal simulation test. The results of the measurement program will be used to verify computer programs for calculating the long-term behavior of the ultimate store.

The test is being carried out jointly by the Federal Institute of Earth Sciences and Raw Materials (BGR), the German Ultimate Waste Disposal Site Construction and Operation Corporation (DBE), the Radiation and Environmental Research Corporation (GSF), and the Karlsruhe Nuclear Research Center (KFK). The overall costs, which are being met by the Federal Ministry of Research and Technology, are in the region of 30 million german marks The test will last three years, but the measuring instruments, heaters, and test containers are so designed that the tests could be extended for another three years if necessary.

Further information is available from Dr. K. D. Closs, Karlsruhe Nuclear Research Center PAE Project Team, P.O. Box 3640, 7500

Karlsruhe. Tel. 07247/825790.

French Firm Develops Superconducting Cable

91WS0056C Paris L'USINE NOUVELLE/ TECHNOLOGIES in French 18 Oct 90 p 24

[Article by Thierry Lucas: "Continuous Production of Superconducting Wire"]

[Text] **The process specially developed by Trefimetaux for superconducting cables eliminates all risks of flaking of the coating.**

The Net project (Next European Torus) prepares the next generation of nuclear-fusion reactors. In facilities of this type, superconducting cables create intense magnetic fields to confine the matter which is held in the

plasma state. In the future reactor, a superconducting Nb_3Sn alloy (instead of the "traditional" NbTi) will make it possible to further enhance performance characteristics. To protect the 175,000 km of wire required for the Net project, Trefimetaux has developed a continuous chromium-plating process that eliminates any risk of flaking of the coating.

"The role of the chromium layer is to prevent the thousand wires which form a cable from sticking together during the heat treatments they must undergo," Anne Voirin, who developed the process at Trefimetaux, explained. "The only difficulty was to obtain a coating that would not be brittle, because superconductors wires twisted together into strands are subject to severe deformations." The new coating meets the requirement and is therefore suitable for a continuous production process which includes winding the wire on a pulley.

The process itself is nothing revolutionary: It consists in electrodeposition in a bath containing chromium (VI) ions, with the wire acting as the cathode. The secret resides in the solution formulation, which yields a layer of crystalline chromium whose structure will withstand considerable deformation. The coating is 2 micron thick; in addition to its good mechanical characteristics, it obviously fulfills its protective role: It will withstand high temperatures (24 hours at 750°C in an inert gas atmosphere) and is not altered by the very low temperature of liquid helium. These results were confirmed on an industrial scale.

Several tens of kilometers of wire have already been manufactured, and an order for 120 km is scheduled to be filled soon.

COMPUTERS

Performance of Hungary's Videoton Analyzed

91WS0031A Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 6 Sep 90 pp 1, 3-5

[Interview with Adam Torok, Laszlo Abraham, Laszlo Garami, and Csaba Szabo by Janos Andor Vertes: "Videoton Is Not On The Floor, But It Has To Get Up By Itself"]

[Text] By the end of August the Videoton Monitoring Committee, recently appointed by the minister of industry and trade, had finished its quick study, which contains the medical report, diagnosis and possible cures for the enterprise, which is in a serious financial situation. The leaders of Videoton have 30 days to attach their comments to the report, prepared in six weeks, and since the conclusions may differ in connection with some findings neither the committee nor the ministry wants to make the report public. And Videoton—in this, unfortunately, there is agreement between Janos Kazsmer, the director general who resigned and is now on leave, and the commissioned director general Laszlo Abraham—cites professional interests and business secrets when calling the report strictly confidential.

Our journal, which so far has given preference in this matter to documents as opposed to subjective observations, remains without source material in this situation but we felt that the fate of the largest state electronics enterprise in the country was too important not to give some information about this question, which interests and affects many. We chose the only possible objective solution—we took up in turn the viewpoints of the study and asked Adam Torok, head of the committee, about the findings connected with these. We have supplemented the interview given to COMPUTERWORLD-SZAMITASTECHNIKA—where this seemed necessary—with opinions from other members of the committee or with comments of the Videoton leaders. Before publishing opinions which give a fuller account than any thus far about Videoton it would do no harm to quote the opinion of Laszlo Abraham, the commissioned director general, about the report of the committee:

"I consider this material to be good in large part. There are one or two figures in the data which do not jibe, possibly due to the shortness of time or poorly chosen sources (but maybe this is our fault too). There are debates among us about the conclusions but we would like to work over this material and develop from it a future strategy for Videoton."

Financial Situation, Performance

Adam Torok, chairman of the VEV [Videoton Electronics Enterprise] Monitoring Committee: Some data have appeared in the electronic and printed media about the financial situation of the enterprise. The radio spoke of a ten billion forint deficit. The sum is exaggerated and unrealistic and the word "deficit" cannot be interpreted in this context. Videoton operated at a profit right up to the recent past; a deficit (and this was under half a billion) appeared for the first time in the first half of this year, and it is not customary to prepare a balance at halftime. The problem at the enterprise is that it has very serious debts (these are not deficits!) which come partly from the change in market conditions and partly from the earlier strategic errors of the enterprise leadership.

The debts are of several types, and I do not think it appropriate to simply add them up. We are talking about debts which come due at different times, which are owed to different organs and which have different ways of being settled. According to the findings of the committee these can be settled with state aid and with the cooperation of the enterprise. The existence of debts in itself does not mean that the enterprise is in danger of its life; this would be true only if a solution is not sufficiently swift.

The other source of the financial difficulties is the waiting in line problem which affects the entire country. About half of the shortfalls due to waiting in line are within the enterprise group and so one could try to remove them by mutually crediting the debts and claims. It is very difficult to use these so-called clearing cycles in a national economy as a whole, but it is very easy within such an enterprise group.

Laszlo Abraham, the temporarily commissioned director general of the VEV: This process has started. But there are also units within the enterprise group which have more debts than claims (for example, the VI Company [VIRt, Videoton Industries Joint Stock Company] is such an organization) so one cannot use this cross-compensation beyond certain limits.

Laszlo Garami, member of the committee: Since public opinion is waiting for concrete data let me say that the report does contain precise figures. Videoton owes the tax authorities 5.5 billion forints, although one must add professionally that this includes a one billion afa payment obligation which according to existing laws could be returned within a short time. The medium term credit debt of the firm is 3.3 billion and at current rates of interest the interest burden which must be paid this year in itself exceeds 1 billion forints. The waiting in line balance is a net 2 billion forint debt.

Csaba Szabo, commissioned economic deputy director general: Countering the debts of the enterprise group there are also claims and these total 12 billion forints. If we precisely balance the debts and claims then the net debt of the enterprise group is about 3 billion forints. The constant mixing of the VEV is not fortunate for the enterprise group or for the state enterprise within the group. The claims of the Videoton Electronics Enterprise are 2.3 billion forints and its debts are 1.8 billion so the balance is positive.

Adam Torok: Since the reorganizations have been mentioned in this connection, the Monitoring Committee,

whose authority actually extends only to a state enterprise supervised by the ministry, could not have done its work effectively if it had not studied the enterprise group as a whole. Concerning the financial leadership of the enterprise the committee established that it had not managed in a truly forward looking manner. Some of the debts come from the military industry loans, these come to about 2.9 billion forints. In the mid-1980's Videoton could have settled the old accounts first instead of starting new developments, could have started an accelerated repayment of the loans. In the unstable economic environment which characterized Hungary it was hazardous to believe that the interest level and markets would not change. Videoton became financially vulnerable in this period; debts and claims both increased and big trouble could come from this excessive financial burden, as could have been surmised in 1985-1987.

Laszlo Abraham: At the beginning of the 1980's we felt that if we did not renew ourselves in the area of technology then we would fall so far behind that we would have no chance of survival. We started from the assumption that loans could be obtained from the bank for 8-10-12 percent. There is no enterprise in the world which can work without a significant amount of credit. The problem began with the start of the inflation, when the programs already begun had to be completed. At the same time we had a promise from the MHB [Hungarian Credit Bank] that they would always finance our working assets needs. In contrast to this we could make use of 3 billion in working assets credit for a production value of 16 billion three years ago while last year the credit did not reach 1 billion with a gross production of 33 billion. The consequence of this was that we fell behind with shippers and we became part of the national waiting in line.

Investments, Developments

Adam Torok: Everyone in this country is oppressed by liquidity problems, by waiting in line problems. And if someone has an inherited weakness, like Videoton, and has a lot of loans, but in the meantime still produces at a profit, then it should not distribute the profits, spend money like water or find things to spend money on, rather, first of all, it should try to get its debts into a condition where they can be managed over the long run. Videoton did not do this but instead got into all sorts of things.

Eight different projects are going forward or were going forward at Videoton in parallel. Even the list itself is beautiful. There was Thomson, there was thick film, or Lohse, they invested in the manufacture of equipment oriented circuits, fourth was NYAK [printed circuits], the robot theme at Videoton Automatika was fifth, there was the optics program, seventh the CD manufacture and as the eighth I mention the housing development.

Let us begin with the last, because this is an important theme for the press, but in my opinion this is the smallest problem. I believe the leaders of Videoton that they wanted to settle good experts in Fehervar and could not pay them enough so they had to compensate them with good housing. And a housing development is property embodied in real estate, it is a free decision whether the enterprise gets ready cash from selling real estate in order to ease its debts. So it is stupid to inflate this question.

The remaining seven themes are more important. It can be said about them as a whole that virtually all of them brought in new technologies, all were well founded technically, and the engineers can be proud, there are few such things in Eastern Europe. Of course, speaking cattily, I could say that these are all prestige viewpoints, but I do not want to be catty. Let us say only that each of them was a development looking to the future. But—and the Monitoring Committee had to evaluate the whole thing from this viewpoint—the financial, economic effects are much less favorable than the technical ones.

Even the Videoton leaders do not question the deficit from the export of Thomson televesion sets, so this is a fact. Some of the domestic sales are allegedly profitable, I do not want to dispute that, but the committee found that Videoton lost significant ground on the domestic TV market, so this cannot be called a success. One could point to lots of things here, beginning with the import liberalization, but the television sets manufactured with purchased technology have to compete with Western import, and it appears that they have lost this competition. The trouble with the Thomson project was that the technology and the product became linked too closely together. Videoton bought an outstanding technology from an outstanding firm, but I believe that this outstanding firm imposed outstanding business conditions—for itself. It stipulated that Videoton could sell Thomson television sets in Western Europe only via Thomson. In the light of all this one can still imagine that one should have bought a different license, another product, for another market, with a different parts base; I do not know to what extent these possibilities were studied at the time by the Videoton experts.

Laszlo Abraham: At the time, in 1985, when we began to talk about modernizing television manufacture, it was not easy to find a mixed enterprise partner and the Westerners were not eager even to sign a license contract with a large enterprise belonging to the "Ostblock." Of course we foresaw the stumbling blocks in the Thomson cooperation. That is why we worked out the three-year television manufacturing program which could make manufacture profitable in the end. The big problem is that so far the television factory still has not carried out this so-called "5-25" program—the sale price had to be increased by 25 percent because of the quality parameters, the material prices, the live work expenditure, etc. had to be reduced by 25 percent. We are not very far behind according to the program; by next year it should be economical with the same amount of domestic deliveries and export.

And I must say that if we did not have to operate this Thomson production line under the unique Hungarian

materials acquisition conditions and if we did not have to sell the products through our criticized commercial channels but rather were able to undertake real jobwork (where one does not have to pay the materials price, there is no import duty, etc.) then the production line would be quite economical.

Let me give a few technical data about the Thomson program. In 1986 it took 24 hours to produce a color television set, now it takes less than four hours. Then a television set ran an average 3,000 hours without failure, now this figure is 12,000 hours. The fact that Thomson was willing to buy back these sets is itself shining proof of the quality.

As for the economicalness of export, one again should go back to the television sets of earlier times. Then we got back 50-60 percent of the production cost via Western export; with the Thomson sets this is 70-80 percent. So export is not actually profitable, but the foreign exchange yield is positive, and with it manufacture is of such volume as to make the whole thing economical. I might sum up by saying that—thus far—the Thomson sales are actually a deficit item, but the Thomson program is not a failure.

Adam Torok: The finding of the committee is not that the Thomson program is a failure but rather that one half of the Thomson project was well conceived and the other half was badly conceived. In any case we can agree that at present this program causes a loss and thus a minus and the whole question is how big is a big deficit for a firm struggling with financial difficulties.

But let us turn to the next project. The Lohse investment made possible the installation of a very modern thick film technology, and the plant, originally serving military industry, may find a market in civilian life also. There is no problem with this, the only trouble is that there is no breakout point, because this is a very small area within Videoton, which could become only a tiny little firm.

The same with CD manufacture—Gloria got off to a hard start but it is going now, production is picking up slowly, then it will be able to support itself, but it will not be able to get Videoton out of the mud. And the little projects are not all positive; I would give a minus to the printed circuits, to the robot program, to the optical stores, and to the equipment oriented circuits I would give two minuses. The costs of the optical project have gone to several hundred million forints, from which—if production ever starts—something obviously will be retrieved, but the financial troubles are appearing now, and even now only research is being done. Something may come from the robot program, lots of partner contacts are being built up, but for the time being there is no series manufacture, they have stockpiled lots of parts, the financial burdens are serious. The NYAK project cost an awful lot, they have spent more than a billion forints already. An indisputable export capacity has been created, although the economicalness of export is not at all certain. The big question is why a finished products manufacturer like Videoton poured money into parts at the beginning of an import liberalization process which had obviously started (and in my opinion a good strategy could have suspected this in 1986-87). The utilization of the capacity created for manufacture of equipment oriented circuits is less than 10 percent. It is possible that these developments took place because of the COCOM [Coordinating Committee for Export Control restrictions but it is well known that getting around COCOM was never economical for anyone (look at the East Germans). Neither Videoton nor anybody else needs circuits made by Videoton itself.

In any case the chief problem is not that there are development projects which can be characterized by a minus or even two minuses, the problem is that one cannot write two pluses to any of them, not one of the many investments proved successful enough to get the enterprise group out of the financial situation which Videoton is now in.

Reorganizations in the Last Two-Three Years

Adam Torok: In connection with reorganization matters I would not deal with those charges or slanders according to which the leaders created various corporations and companies in order to get income from more places. The committee collected data pertaining to this too and it can be stated that the leaders got relatively little in premiums or awards under this heading. The losses to the state are to be sought not in the leaders but rather at the enterprise. There are a few projects on which enough has been spent thus far to cover the annual premimums, honoraria and salaries of all the leaders for decades. Anyway, the committee did not feel that it was its task to deal with leader premiums, if only because in the premium rank ordering of top leaders in Hungarian industry these are in the middle field. Certainly this irritates many, but really these are not the essential questions. Just as the self-help association is not a central question. The committee condemned this affair and it should be reversed—if there is a legal remedy. An odd, debatable step was taken, one which may be illegal, but in contrast to the conjectures which appeared in the press money did not disappear, because money was not involved in the deal. They talk about the irregular transfer of a billion forints but what is involved is the cross-property of the VI Company and the VEV, three billion according to the plan but at present only one billion; it was simply stock shares moving between two enterprises which are linked together. If we emphasize such "showy" matters we will not be able to concentrate on what is essential.

Laszlo Abraham: People talk a great deal today about the social safety net. I believe that the self-help association is the only working social safety net. One could argue about the magnitude, it can be imagined that the association does not need a property share worth 3 billion, one might be enough, but I think that this step defends the enterprise collective on an individual basis.

Adam Torok: Let us look at the essential questions! One could judge the reorganization affairs in many ways, in this case Videoton had a good number of Western examples, and no one doubts the basic principles of structural transformation. But it is a cause for doubt when an enterprise suffering a personnel shortage in the economic and marketing area "distributes" this shortage among member enterprises, that it creates units which start with a disadvantage in this area. Decentralization automatically increases administrative personnel and at this time this can hardly be called positive. Accounting links were developed among the member enterprises—apparently for market reasons but actually on the basis of directive—which obviously increased costs.

For example, this played a role in the creation of deficits in the Thomson program—although the leaders of the VEV try to deny it. The strategic basis for the dispersed reorganization may have been that one should concentrate on the chief profiles and make the side profiles—audio, parts, equipment oriented circuits—independent, abandon them to their fate. There were nice sounding Western studies to this effect, which spoke of a diversification phase, an integration phase, etc.

But the picture shows that the essence of the whole reorganization was to get the enterprise group out from under state supervision. The Videoton Electronics Enterprise remained as a holding company while the bulk of the production went to the Videoton Industries Company. Although there are more than two dozen organizational units the majority of these have no significant capital strength—even if one or two, like Gloria for example, have prospects—so from the product structure viewpoint the VI Company remained the real large unit. That is why one cannot see the economic profit of the reorganization; what one can see is a maneuver aimed at restructuring the relationship to the state.

What is even stranger is that the second phase began this year; by the end of this phase the VI Company will be emptied out too, and a second property center is needed. This became TV Limited, the electromechanical and apparatus manufacturer. The little enterprises are proliferating, the holding companies are now proliferating slowly—their number doubled completely superfluously—and this really tangles the property relationships within the enterprise. The state, as owner, finds it much more difficult now to see what its property there is good for, how to move it, how to get it out, what financial profits can be expected from it. Indeed, such a complicated structure has been created that now, when the enterprise wants to extricate itself, it is confused itself.

International Cooperation

Adam Torok: The system of foreign contacts, bringing in capital and market policy are very essential parts of surveying the situation. Bringing foreign capital into Videoton has begun. I list the firms which have invested in three groups. One, to which various Liechtenstein, Cyprus, or other smaller firms belong, is simply investing capital and has nothing to do with the technical field. About these one should know that one cannot expect a significant amount of capital from them; their only advantage is that they are Western. They have no fame, name or technology.

In the second group are those who also bring in technology but for whom the capital investment is not too significant. We find these in CD manufacture and in the thick film technology. We can say here that the level of the imported technology is such that these firms will provide employment, even in the future, for several dozen or several hundred people, even if they do so independently; they will be viable for the long term. But these—because of their size—are not capable of getting Videoton out of trouble, the capital strength is tiny.

The third type of capital import is where Videoton has developed contacts with technically developed firms with capital strength. Examples here are SEL and Bull. The former by itself would be beautiful, even splendid, if, if Videoton-SEL wins the postal tender for building telephone exchanges. But no one can guarantee this, there are nine competing, of them two could win, and today we are not in a position where a government order could be given to tell those holding the competition which to choose. The factors certainly include, however, where the financing conditions are best and in this the SEL side is important too. But let us stick with a simple qualification; SEL is good, if it gets in. There should be, let us say, eight such and then one or two would be sure to get in.

Bull remains the key question; the choice is perfect technically; but it appears that between the production capacity of Videoton and the marketing organization of Videoton Bull is interested primarily in the latter. This organization is extraordinarily valuable (in a certain sense Videoton may underestimate the value of the market infrastructure it has built up) and this is what Bull needs—primarily the Soviet market possibility. There is no guarantee that this outstanding firm would also care to set to rights and exploit the computer technology production capacity of Videoton.

There are two things we should not mix together in connection with the Soviet market. In its distribution strategy Videoton must reduce the role of the Soviet market, but this does not contradict the fact that the market organization is of great value. This value, however, appears primarily for him who, having a strong bargaining position, can get significant counter-value from it. Unfortunately it is difficult to imagine that Videoton could win such a position for itself. In contacts of the Bull type the interest of Videoton would be for the Western firm first to undertake to get the production capacity going, to exploit it, and then to make it possible for Videoton to get some segments on the Western markets; then, exploiting Videoton's market organization, the Western firm would export to the Soviet market, and fight for the compensation. Videoton itself must simply forget the strategic role of the Soviet

market. The trouble with those bombastic plans which count on sales on the Soviet market worth 830 million dollars is not that they represent bargaining tactics, that this figure should be reduced by 10 or 20 percent, but rather that this figure simply doesn't fit by an order of magnitude.

Laszlo Abraham: The enterprise was selling in the Soviet direction up to now and we developed our product structure, technology and quality control system accordingly; one cannot do an about face over night and direct about half of the production to Western markets.

Adam Torok: In the case of TV Videoton itself restricted its Western market positions on the basis of the agreement with Thomson. One cannot criticize Thomson for this, it got what it could, but from the viewpoint of Videoton it was a great blunder to accept such a restriction in regard to its chief product. In the consumer goods profile there are one or two things—audio, loudspeakers, etc.—which may be worth more than people think, more than the emphasis they are receiving.

In computer technology the enterprise leadership mixed a very correct tactic with an incorrect strategy. The leaders correctly felt that they could still sell obsolete computers on the Soviet market, but they did not recognize in time that real market conditions were approaching and that a change in concept would be needed. Beginning in 1986-87 one could suspect that the military market would narrow significantly, the enterprise did cleverly modify investment goals while under way; it is another question that the money finally went into civilian projects which did not prove successful.

Of course the foreign contacts in themselves cannot be made responsible for the difficult situation, but this substracts nothing from the weight of the finding that the international strategy of Videoton is embryonic and onesided. Why does Videoton not exploit its opportunities in such countries as Czechoslovakia, Bulgaria and Poland? As far as I know sales have fallen off even in Yugoslavia, which I cannot understand. One should see whether Videoton might not have a place on the market of Turkey, with a population of 40 million. Austria is another example. It appears that much could be earned with good marketing work in the so-called peripheral zone of Western Europe. The Soviet Union too is a prospective market, but only in this order of magnitude, not as a strategic factor.

Directions for Setting Things Right

Adam Torok: Videoton wants us to believe that it is on the floor, through no fault of its own. In contrast to this the committee found that Videoton has not been counted out yet, but that it is responsible for some of the blows which have shaken it. The military industry is a typical example of this; it was very convenient to trust in inter-governmental contacts and not to worry about where and for how long the technology could be sold. So Videoton stuck out its chin for the blow. The enterprise can still get on its feet, partly by converting part of the military investments to civilian purposes and partly by slowing the phasing out of classical military production, making it gradual with good market policy, by manufacturing spare parts, etc.

I do not want to talk about the proposals made for setting things right, because this is the responsibility of the minister; the committee has surveyed the situation and made certain recommendations; the decision is not our job. At most I would outline the possible directions and let the reader draw the conclusions. One idea—I need not say that it is the enterprise's idea—is that Videoton should get maximum relief from its financial burdens, that the budget should pay the bills. In the present economic situation the ministry—I feel—will certainly reject this version.

Another solution would be to place the enterprise under bank supervision—for its debts. The Monitoring Committee does not support this possibility, in the interest of the enterprise, although the fact that we do not support something does not mean that the thing is excluded—due to the legal position of the committee.

The third solution would be a partial sale based on a precise survey of the property; of course there are a number of sub-versions of this according to what production capacity or real estate the enterprise would sell. There are property elements which may not play too great a role in the long-range strategy of the enterprise, but this would get us into details. Let us stick with this, the minister of industry and trade will presumably inform the press about the way out—when the 30 days for comment from Videoton have expired.

Romanian IBM-Compatible PC Described

91WS0013A Bucharest TRIBUNA ECONOMICA in Romanian 22 Jun 90 p 20

[Article: "The Junior-XT Microcomputer"]

[Text] The Junior-XT microcomputer made by the Peripheral Equipment Enterprise in Bucharest is a professional personal computer compatible with the IBM PC-XT computer. In contrast to the initial model made by IBM, which was based on the INTEL 8088 microprocessor, the Junior-XT uses the INTEL 8086 microprocessor. The 8086 is superior to the 8088 because it is entirely an 8-bit processor (from both the hardware and software standpoints), and thus is faster. The 8088 has the same instruction set as the 8086, but has an external 8-bit data bus, transfers of 16 bits being time multiplexed.

The microprocessor of the Junior-XT operates at a clock speed of 4.77 Megaherz. In the standard configuration, the Junior has 640 kilobytes of RAM (with extended memory), a color graphics adapter (CGA), floppy disk controller, and a coupler with one parallel interface connection (for a printer) and two V24 (RS 232 C) serial connections.

Insofar as the user is concerned, the Junior-XT consists of three modules, a central unit, monitor, and keyboard.

In its current version the Junior is delivered with a monochrome monitor (green phosphor). The central unit also includes two 5.25-inch floppy disk drives with a capacity of 360 kilobytes and 720 kilobytes. If there is also a hard disk drive (which may measure 5.15 inches or 3.5 inches and have a capacity ranging from 20 to 70 megabytes), it is mounted inside the central unit.

The total hardware compatibility with the IBM PC-XT makes it possible to run all the software written for the XT, beginning of course with the MS-DOS (or PC-DOS) operating system in its different versions.

The most interesting and useful applications are in the CAD/CAE (Computer Aided Design/Computer Aided Engineering) field, in the form of software programs such as AUTOCAD, ORCAD, REDAC, etc. They are useful in a number of areas, such as mechanics, electronics, architecture, and construction. Traditional computer applications such as office management, education, and games are also thoroughly supported by various applications programs, such as powerful text editors, graphics editors, and database management systems.

One useful configuration for users of the Junior-XT computer is that of a graphics station, which comprises a plotter of the PIF family and a graphic printer of the IMPACT type connected to the computer. Both items are part of the Peripheral Equipment Enterprise product range in demand. The two pieces of equipment can be coupled by means of a parallel interface (for a printer) and one of the two serial interfaces for the plotter.

Another option is a mathematical coprocessor, which increases the operating speed threefold to fourfold in floating point operation.

The Junior-XT can support a wide range of local applications in all areas of activity.

First Hungarian Boot Virus Described

91WS0007B Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 30 Aug 90 p 10

[Article by J. K.: "A Filler, Hungarian Style"]

[Text] The first domestic boot virus has been born, unfortunately. The condition for its activation is that the internal clock of the computer shows 1 July 1990, or a later date. The virus only spreads up to that date; after that, on the 21st system start, it destroys the floppy disk which can be found in drive A: and the FAT [file allocation table] of the hard disk.

The virus, which attacks the booting sector, is one of the most intelligent programs ever written in this art form. Its authors (or author) have synthesized in it all the programming knowledge which has come to light so far concerning boot viruses. The presence of the Filler on the disk cannot be sensed with any customary tool! If it is in memory it always displays the undamaged part of the boot sector, with whatever program we want to check the disk. Following the traditions of the (C) Brain virus it protects itself against auxiliary programs which write directly to disk. Its developer may have had access to the documentation of the BOOTKILL program package in which the authors of BOOTKILL described for lay users how a boot virus replaces the booting sector. We can recognize the presence of unknown viruses only by failing to find the usual textual system message in this sector. Well, this is the first boot virus which, after infecting the hard disk, does not replace the entire partition table but rather replaces its program. It leaves the system messages unchanged.

The Virus Hunters group of Szolinfo took two days to develop an antidote. At all their retail dealers they have replaced the BOOTKILL program with a new 1.04 version which not only can remove the Filler from memory but also, in most cases, can restore the hard disk after the "explosion" of the virus.

The virus spreads only with a system disk. If it is in memory a single DIR command given to a clean system disk is enough to infect it. It does not fit into the partition table on a floppy disk for it is a big one by program virus standards, with a code length of more than 4 kilobytes. So the original BOOT program and a large part of the body of it are placed on band 40 of a 360 kilobyte disk, first formatting the sectors there. Its system messages are contained in coded form so they cannot be recognized by text searches. This is a professional job. Judging by how it handles a Winchester the virus was prepared on a computer with a 20 megabyte hard disk unit. As the virus explodes it writes the following system message on the screen in the Hungarian language: "Hahaha, virus van a gepben!!!" [Hahaha, there is a virus in the computer!!!]

So far few have met up with it but it can be predicted that it will soon become well known. It's name is simply Filler [Toltogeto]. It got this name because it fills the FAT table with various figures. In the case we studied it uses the ASCII 01 (skull) characters which it arranges to form a similar figure in the FAT. It puts eight of these figures, made from moon faces, in one sector.

As with the rewritten VacSina (singing) versions of Hungarian origin it remains in memory even after a restart with the CTRL-ALT-DEL keys. It can be removed only by turning off the main switch or by the new 1.04 version of BOOTKILL.

Infections were reported from Komarom, Tatabanya, and Budapest in the middle of July. The virus was probably let loose by its humorous developer at the end of March. On the basis of epidemiological analyses from human experience it probably started in Budapest and in Komarom-Esztergom county. The epidemic will probably peak at the end of August and the beginning of September. A part is played in this by the fact that all the antivirus programs now known are ineffective against it

since we are talking about an original software virus developed in Hungary. At this writing only one program eliminates it, BOOTKILL version 1.04 already mentioned, which was developed by Imre Szegedi and Istvan Farmosi in record time. It can be obtained for 400 forints from Szolinfo (1118 Budapest, Bozokvar street 11, telephone 181-2646, fax 166-5413), from the Kiraly (Majakovszkij) street shop of the Instrument Technology Company or from the Floppyland shop, Budapest V, Vaci street 84, of the Cedrus Company.

Activities of Hungarian R&D Company Described

91WS0007C Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 23 Aug 90 p 3

[Interview by Istvan Dalicsek with Gyorgy Surek, managing director of R Research and Development Ltd.: "The R Line"]

[Text] The name is R Research and Development Limited and the slogan is "From basic research to final completion." Nice, but it says little about the firm itself. We asked the managing director of the undertaking, Gyorgy Surek, about the details.

The R corporation was formed in the middle of 1989, but it was already present earlier under another name and in a different organizational form. Its workers—there are now only 14 of them full time—are mathematicians, physicists, chemists, physicians, engineers, and computer technology experts. They deal with design and manufacture of industrial and laboratory measurement data collection and control systems, with special emphasis on mathematical procedures aiding the processing of the results of the measurements. Their software developers also prepare independent program systems. They have a special division for development and manufacture of medical instruments and for medical research.

Their laboratories and mechanical shops operate in Budapest and Szombathely. The two sections can be called equivalent to one another; personal contacts played a role in their formation.

COMPUTERWORLD: Why did just R become the name of the company?

Surek: It is rather difficult to explain why we chose this name. R is a nice letter, it is the first letter of the words "research" and "repules" [flying] which are things we are involved in. As a matter of interest I might mention that it turned out that there is a Belgian firm the name of which is simply R, and our sphere of activity is similar.

COMPUTERWORLD: According to your degree you are an astronomer. How did an astronomer become chief of a computer engineering company?

Surek: R is not a computer engineering firm in the classical sense. For us a computer is a tool to solve a given problem. Astronomy always required considerable mathematical computation; this cannot be imagined today without computers. I might note that an astronomer developed the FORTH programming language and used it to control the movements of a telescope.

R Ltd. undertakes to solve research and development tasks in the most varied areas of technical and scientific life, preparing software which requires special mathematical procedures—such as harmonic analysis, numeric solution of differential equations, function curve matching, smoothing, numeric derivation, linear programming or mathematical statistical methods.

We make computerized measurement data collection and control systems, error tolerant control equipment and measurement heads; we design and manufacture detectors and we deal with image processing and expert systems.

COMPUTERWORLD: Can one live on the Hungarian market from development and manufacture?

Surek: Although the present economic environment and rules do not favor manufacture or development I can say yes. We try to put more ideas and new solutions into our developments; often these are needed because of the conditions.

And we have jobs we started on our own, in the hope of later success. We do what we understand and what we like.

COMPUTERWORLD: What sort of products carry the R emblem?

Surek: We have developed and are selling a TV sound panel; we are working on uninterrupted power sources. Our A/D card family is being made as part of a cooperation project. Here everyone can choose a version fitting his needs and pocketbook. The price of the smallest member of the family is less than 13,000 forints. The cards have user-friendly software drives which are very simple to install. So a clever person can have them working two hours after purchase.

Within weeks we will be marketing the plotter shown at the Budapest International Fair. It can be used with Commodore 64 or IBM PC compatible computers. Its maximum drawing size is A/3. Its net price will be around 10,000 forints. This is not a typo! The low price is the result of immense time turned to development and the cost reducing solutions used. It is a tough, reliable design. Naturally we do not intend it for the most complex CAD [computet aided design] applications, but it is outstanding for preparing mechanical drawings and this could attract even private individuals who have a C64 computer.

Computerized procedures greatly increase the value of EEG diagnoses in routine clinical tests. After several years of work we now have a computerized EEG analysis system, the R-EEG-16. The equipment can be connected to any 16 channel EEG device and with its aid the data of 16 EEG channels can be processed quickly—even

during the visit. The machine can operate in the online mode, when we examine the channels together with the measurement, and in the offline mode, a way to process measurement values recorded earlier. The functions realized are direct indication, spectrum, topography and statistics. The price for the whole thing, with computer, is 455,400 forints.

A significant but still uncompleted development is a neurological expert system which runs on a PC. The tests thus far are reassuring and we hope the market reception will be favorable too.

TECHNOLOGY TRANSFER

COCOM-Proscribed CAD/CAM System Acquired

91WS0007A Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 30 Aug 90 p 7

[Article by Katalin Magos: "Space Machine"]

[Text] With the shortening of the COCOM [Coordinating Committee for Export Control] list one can now obtain here also, in the PC salon of Novotrade, the computer controlled modeling machines of the Roland Digital Group.

The CAMM-1 model does not differ much from a plotter; in place of a pen there is a knife with which one can cut out optional figures primarily from self-sticking foil but also from any other material used in printing technology. The movement of the knife can be programmed in the HP-GL language, generally used for plotters, so the forms or drawings can be designed with any HP-GL output program, such as AutoCAD. The pressure of the knife can be set by hand, so the machine can be used for materials of different quality. The CAMM-1 also has a serial and a parallel interface. Inscriptions can be prepared without a computer too, using the built-in letter set of the device. Since the content of the data memory remains even after switching off one can reproduce without limit drawings not larger than 8 kilobytes without making further use of a computer.

In the CAMM-2 model there is an engraving head in place of the knife; the tool can be changed so it can be used to work plastic, aluminum or brass sheet. The largest sheet size which can be used is 200 by 140 mm. Its computer engineering properties are the same as the preceding model.

The CAMM-3 model is really new; it is actually a tiny (50 x 58 x 58 cm, 55 kg) single axis CNC machining tool. The space can be controlled in all three directions with a personal computer; it can be programmed with a precision of 0.01 mm in its own CAMM-GL1 language, since plotters do not recognize the Z direction. The size of the work field is 180(X) x 150(Y) x 150(Z) mm; the field can be filled with modeling wax, plastic, wood, aluminum or brass. It can also be operated by hand, the movement sequence recorded and repeated on command—it can be taught.

So let's go form designers! (And programmers! You will also need an AutoCAD.DFX—form description—CAMM-GL1 compiler.)

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